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MAY, 1977
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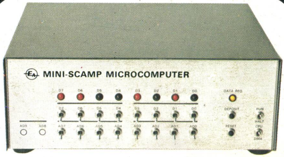

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BONUS CATALOG

Just in case you haven't noticed it yet, this issue carries a special bonus insert: a whopping 84-page "Supercatalog" from Dick Smith Electronics. Normally costing 75c, it provides not only products and prices, but data, information, ideas and circuits as well. You'll find it if you turn to page 60 . . .

Don't miss these great projects:

- **New high performance hi-fi speaker system, featuring 3 drivers & level controls/32**
- **High gain, low noise preamp for boosting performance of 27MHz CB-type rigs/44**
- **Easy-to-build gas detector for boats, exhaust analyser for cars and trucks/52**
- **Simple, low cost RTTY modulator for radio hams/62**
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On the cover

Helping to brighten our cover this month is Miss Regina Bruns, who won the "Miss Quest of Nations" title for 1977. She is sitting on a prototype of our new Playmaster 3-75L hi-fi speaker enclosure, which was developed in association with Dick Smith Electronics. You can read all about the new project inside on page 32. (Picture by courtesy Dick Smith Electronics Pty Ltd.)

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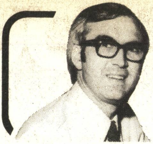

Editorial Viewpoint

The future brightens for solar energy

As I sit down to write this, it has just been announced that the NSW State Government will give a grant of $1.08 million to the University of Sydney's Science Foundation, for solar energy research. This is welcome news indeed, particularly in view of the continuing debate about nuclear energy and uranium mining.

Quite apart from the problems of safety and economic viability associated with nuclear energy, there is another and often-overlooked problem—one which it shares with traditional fossil-fuel techniques. This is that like coal and oil, uranium is a finite and exhaustible resource. To be sure, a tonne of uranium will produce many times the energy which may currently be extracted from a tonne of coal or oil; but the fact remains that once the world's finite supply of uranium is used up, there is no foreseeable way of replacing it.

Solar energy does not share this disadvantage, at least in an immediate and direct way. There may be environmental and ecological complications associated with large-scale centralised solar energy plants, but at least the basic fuel itself is virtually inexhaustible. By the time our Sun dies, we will presumably have had a few hundred thousand years to work out how to find a replacement—if we humans haven't killed ourselves off by then, that is!

In view of this it seems to me that we should be directing very much more attention to solar energy, both in terms of direct heat extraction and in the area of conversion to electrical energy. And to further subdivide the latter field, into both conventional large-scale centralised generating plants and the partly alternative or complementary concept of distributed conversion. There is also the largely unexplored area of integrated heating/generation facilities.

Australia seems an ideal place to work on these possibilities, and judging by the results already produced by the CSIRO, the University of Sydney and other facilities—all of it produced so far on the traditional "shoestring"—we seem to have no shortage of enthusiastic and capable researchers.

Let us hope, then, that this very timely grant by the NSW Government is the first of many to encourage solar energy research in Australia. With this sort of encouragement, it could well be that Australian scientists and engineers will show the rest of the world how it can be done.

They did it with the Interscan microwave landing system, and with a bit of encouragement and support I believe they could do it again.

—Jamieson Rowe

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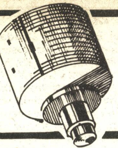


News Highlights

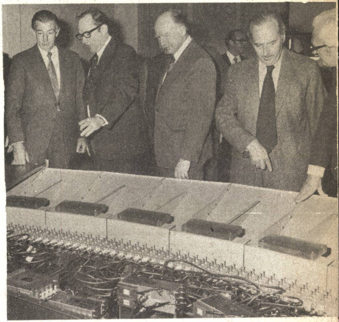
ICAO selects Australia's Interscan MLS

The advisory committee of the International Civil Aviation Organisation (ICAO) has finally selected the Australian-designed Interscan microwave landing system for the world's 3200 major airports. The committee's recommendation will be put to the vote by the ICAO's 138 member nations later this year, but the stage now seems set for Interscan to become the endorsed system.

The decision testifies to the technical excellence of Interscan, developed jointly by the CSIRO's Division of Radiophysics and the Department of Transport. It is also a tribute to the energy and enthusiasm of Dr. Paul Wild, one of the key CSIRO scientists behind the development of Interscan, who has spent much of his time convincing ICAO members of the system's worth.

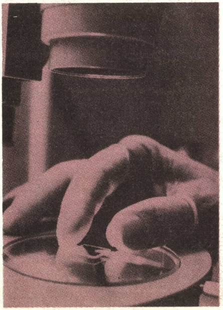
All told, Interscan is believed to have cost the Australian taxpayer around $5 million, including about $1.1 million to market the system and promote it to the ICAO and its member countries. Thanks to some key patents, this money is likely to be recovered—but the investment isn't likely to reap the huge returns which one might expect from the adoption of Interscan as the world-wide MLS. This is because one of the conditions made by the ICAO was that Australia could not claim a monopoly on Interscan's manufacture or use.

Still, Dr. Wild and the rest of the team responsible for Interscan will have the satisfaction of knowing that their brainchild triumphed, despite intense competition from big guns in Britain, the USA, Germany and France. And it seems to have done this solely because of superior performance.



Taken at a presentation of Interscan in late 1974, this picture shows former Transport Minister Charles Jones with AWA engineers.

Smallest-ever Bible: 4 micron letters



A Dallas firm, with the help of a high-resolution photo-sensitive glass plate, has reduced the contents of a 1,500-page Bible to the area of a 5-cent piece.

Ralph McNeely, Gerald Ammerman and Ronald Price of Micrometrology Laboratories, used 35mm Kodak high contrast copy film 5069 to record two pages per frame on a 35mm single-lens reflex camera. Medium for the finished version was 5 x 5cm Kodak high resolution plate, from a microscope camera.

McNeely said: "The high-resolution plate is made from very special quality, selected flat glass, coated with an emulsion about five micrometres thick. It's capable of resolving 2,000 lines per millimetre, which was essential. We were planning on producting letters just 3.8 microns high and 0.75 micron body width. Each page of the finished Bible would measure only 0.05cm high by 0.03cm wide."

The microscope camera for this operation was hand-built over a period of several years. The camera had a 135kg cast iron frame braced for rigidity, because of the extremely tight tolerances required for filming.

As a further safeguard, all work was done at night when even a small amount of neighbourhood activity in the laboratory's secluded location had ceased. But even with these precautions, the rumble of a distant train ruined an early effort.

Extreme care was taken in cleaning plates before each exposure, because even the smallest extraneous particle adhering to the surface of the Kodak plate would have been imaged by the high-resolution emulsion.

Tight control also was placed over air pressure for the air gauge, to achieve the sharpest possible focus. Each plate was exposed at one sitting which took more than five hours each.

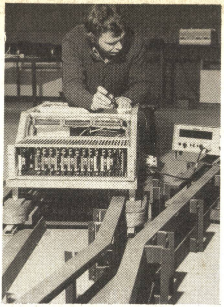
The entire Bible contents now repose on a glass chip in an array of 50 pages across by 31 pages deep. It has been presented to the Smithsonian Institution.

Route switching for mag-lev vehicles

A research vehicle (right) is prepared for a test run on a new system for switching magnetically suspended vehicles from one route to another in a laboratory at Sussex University in south-east England.

Research has until recently been concentrated on perfecting the technique of magnetic levitation using electromagnets attached to the vehicle's chassis and attracted to the underneath of the guide rails. Route-switching, however, raises new problems. The length of the necessary gap in the rails at a junction varies according to the radius of the curve, which can be gentle or sharp. In the former case, the absence of a rail can be as long as a carriage length, leaving one side of the vehicle unsupported.

To overcome the problem, scientists at the University have built magnets which attract on both sides instead of only one. Where a gap occurs at a junction, another rail is placed on the inside, overlapping and parallel to the outside rail. This allows the magnet to attract continuously either on the inside or outside rail, giving the vehicle constant support.



The University has for some time been able to suspend magnetically and to propel vehicles weighing up to one tonne. Their latest research is believed to be the most advanced in the development of a successful route-switching technique.

Cutbacks at WWV

The National Bureau of Standards (NBS) has discontinued broadcasts on three frequencies from WWV (2.5, 20, 25 MHz) and one frequency from WWVH (20 MHz). All broadcasts from these standard time and frequency short-wave stations on other frequencies remain unchanged in power and format. The reduction in the number of frequencies took place from February 1st 1977, and was undertaken to reduce station operating costs.

In 1975, NBS conducted a large scale survey to determine the diversified users of standard time and frequency broadcast stations WWV and WWVH. This survey permitted NBS to compare its costs of providing the services to actual user benefits.

The survey was prompted by escalating costs of electrical power for broadcasts, station staffing, and other aspects of operations. The energy crisis alone has more than doubled the cost of electrical power to WWVH, currently in excess of $100,000 annually.

Survey results, from over 12,000 worldwide users, clearly demonstrated that the broadcasts on 5, 10, and 15MHz by WWV near Fort Collins, Colorado, and WWVH on the island of Kauai in Hawaii, are "frequently" or "sometimes" used 80%, 91%, and 78% respectively. In contrast, the 2.5, 20, and 25MHz broadcasts are "never" used by 81%.

Cost analysis demonstrated that elimination of lesser-used 2.5, 20, and 25MHz broadcasts could reduce station power consumption by 12%. Also, some of the freed transmitters could be used as back-up units in an automated system, allowing a significant reduction in station labour costs. This will enhance the reliability of the 5, 10, and 15MHz key frequencies for both stations, without the purchase of additional transmitters.

Signetics & NS sign uP agreement

The latest cross-licensing agreement to emerge in the dynamic microprocessor market has been announced by Signetics Corporation and National Semiconductor Corporation. The two have signed an agreement to manufacture and supply each other's proprietary 8-bit microprocessors. National is to second-source the Signetics 2650, while signetics will be second-sourcing the National SC/MP-II.

As both products are relatively late entries in the microprocessor stakes, the agreement should be of considerable mutual benefit.

The new agreement is seen as the first step in a series of co-operative product exchanges between the two firms.

Mobile laboratory to study road lighting

Pictured at right is a mobile lighting aboratory which has been imported by Philips Lighting Industries to assist in sur-eying road lighting. The Philips "Light Van" has already been made available to ssist lighting authorities in 15 European ountries, and in South Africa. It is equip-ed to take continuous measurements of oad surface luminance, uniformity and lare produced by street lighting installa-ons.

A computer terminal enables technical alculations to be carried out in situ. The an can also demonstrate various lamp ypes, street lighting luminaires, and oodlights. It is fitted with a 2kW supply nd a 20 metre telescopic mast.

The van is to take part in surveys in NSW, Victoria, Queensland and South ustralia. It will also be used for esearch.

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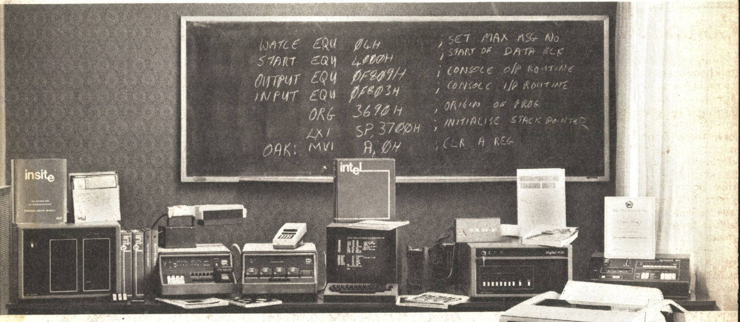

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WATCE   EQU  06H      ; SET MAX MSG NO
START   EQU  4000H    ; START OF DATA BLK
OUTPUT  EQU  0F809H   ; CONSOLE O/P ROUTINE
INPUT   EQU  0F803H   ; CONSOLE I/P ROUTINE
        ORG  3690H    ; ORIGIN OF PROG
        LXI  SP,3700H ; INITIALISE STACK POINTER
OAK:    MVI  A,0H     ; CLR A REG
```

Picture shows some of the equipment available at the Microprocessor User Centre at Auburn.

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WFMPC3

NEWS HIGHLIGHTS

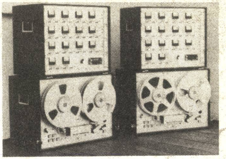
Micro-TV finally hits UK market

A television set with a 50.8mm (two-inch) screen—truly portable with performance in reception, picture and sound quality—has been launched by a British company after twelve years' research, design and development.

The Sinclair Microvision works from four internal rechargeable batteries—giving four hours' continuous viewing—or direct from the mains. It measures 101.6mm (four inches) wide, 152.4mm (six inches) from front to back, 38mm (one and a half inches) deep and weighs only 740 grammes (26½ ounces).

Much of the research has been spent on the final receiver design to embody new techniques of reducing power consumption. The bulk of the circuitry is achieved in five integrated circuits, which include about 300 transistors. This results in a very low overall power consumption with a correspondingly low internal power dissipation, giving external radiation figures lower than a conventional receiver. The research has been aided by a West German company who have produced the tiny picture tube which itself employs new technology in picture quality and uses a very low-power heater.

Tape recorders to ride the rails



The Railway Laboratory Engineering Investigation Section of the NSW Public Transport Commission has recently taken delivery of two special purpose instrumentation tape recorders. Built at 18 Coward Street, Mascot, by Electrodata Associates Pty Ltd, the 14 channel IRIG compatible recorders are intended for investigations into rail vehicle stability and riding.

The recorders feature built in oscilloscopes for monitoring inputs and outputs of all data channels, and are each housed in two cases for ease of transportability.

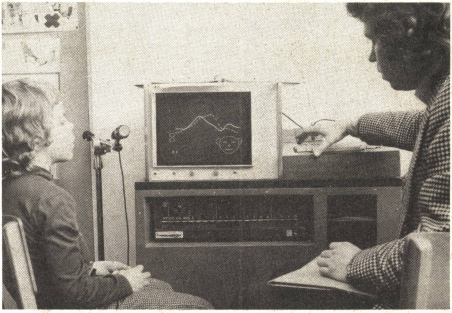
Electrodata Associates Pty Ltd, is an Australian company specializing in the design and manufacture of special purpose tape recorders. In addition to having standard instrumentation, voice logging and tape duplication equipment, Electrodata can undertake specialized design work to suit customer's particular requirement.

Computer & TV help deaf children learn to speak

Bringing a smile to the face of the teddy bear on the television screen may seem like a game; but for this child at a special school for deaf children in Cambridge, eastern England, it is an encouraging step in the difficult process of learning to speak. The school is using a computerised system, recently developed by the Cambridge University Department of Engineering, that will help deaf or partially-hearing children overcome their major problem of not being able to hear what they are saying by enabling them to 'see' the sounds they make.

The child's sound is shown in the form of a line on the television screen. The aim is for him to match his line with a target line which represents the sound as it should be made. To provide an added encouragement for the younger child, the face of the teddy bear will smile when the two lines coincide. A less successful attempt will produce a grimace.

Other information that can be shown includes a word which contains the vowel sound the child is trying to make. The sounds are selected by the teacher on an easy-to-use terminal attached to the system.



Already, the specialist teachers who are evaluating the prototype system are finding the results very encouraging and the engineers are working on further developments which will provide greater scope and reduce the cost to make it available to many schools.

This is the Swann Electronics Professional Edge Connector Kit: the kit that saves you the considerable expense of having prototypes or small orders made up to your specs. Fit only the contacts you actually require! Fool proof to assemble.

The Ferranti-designed base can be used single-sided for 62-way connections, or double-sided for 124-way connections.

The Standard kit comprises two bases, 175 gold-plated phosphor-bronze contacts coined for maximum spring, 6 open end brackets, 6 closed end brackets and 4 polarising keys.

The Single base kit contains 85 contacts, 2 open end brackets, 2 closed end brackets and 2 polarising keys.

Use this coupon to order now.

To: Swann Electronics, P.O. Box 350, Mt. Waverley, Vic. 3149. Ph. 544 3033. Please send me:

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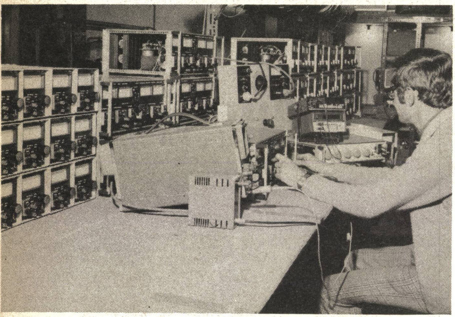
NEWS HIGHLIGHTS

ABC contract to Statronics



The ABC has awarded a contract to Statronics Pty Ltd for power supplies to be used in various television studio centres throughout Australia.

The contract, worth $33,500, called for 0-50V and 0-15V supplies with a wide range of measurement capabilities. Types chosen were the PRS262 dual supply capable of delivering up to 2A per channel at 50V, and the LPR153 15V, 3A single supply.

The PRS262 supplies were fitted with programmable crowbar over-voltage protection, series tracking and parallel load sharing facilities. Switchable remote sensing was also incorporated together with digital readout for voltage, current and over-voltage programming. The LPR153s were also fitted with crowbar protection and digital readout on voltage programming. Pictured above is Statronics' Rod Tuson during final testing.

Statronics Pty Ltd offer a range of standard power supplies with a wide range of options. The company is at 103 Hunter St, Hornsby 2077.

News briefs

MELBOURNE MICROCOMPUTER CLUB

Readers living in the Melbourne area who have an interest in microcomputers will no doubt be happy to hear of the formation of the Microcomputer Club of Melbourne (MICOM). The initial meeting was held on 19th March, at which approximately 50 people were present.

Enquiries from anyone interested are welcome, and can be directed to Roger Edgecombe on (03) 836 1077 (bus. hours).

A & R ENGAGES CHIEF ENGINEER

Mr Bernie O'Shannassy has joined A & R Electronic Equipment Co Pty Ltd as Chief Engineer responsible for the Transformer and Equipment Design Engineering groups and for Quality Control.

Prior to joining A & R Mr O'Shannasy was with Motorola Communications Australasia for 2½ years as Manufacturing Manager and was responsible for establishing their manufacturing operation in Mulgrave. Before that he spent 9 years with Fairchild Australia Pty Ltd, originally with the Product Applications engineering group, then later as Product Marketing Manager and finally as Manufacturing Manager.

BWD CLOSES NSW OFFICE

Following the tragic death in the Granville rail disaster of Mr Hal Cranfield, NSW regional manager for BWD Electronics, BWD has closed its Blues Point Road office in Sydney and transferred all sales and service activities to BWD's authorised distributor, Amalgamated Wireless (A'asia) Ltd, 422 Lane Cove Road, North Ryde, NSW 2113.

All enquiries directed to their distributor—or if preferred to BWD head office in Melbourne—will receive immediate attention. BWD's head office postal address is PO Box 325, Springvale, Vic 3171.

Remote control CTV for hospital patients

Patients in a Brisbane hospital will soon be able to select their favourite TV or sound program by using a built-in attachment to the nurse call handset.

AWA Rediffusion, a subsidiary of AWA (Aust.) Ltd, is installing the system at the Wesley Private Hospital as part of a major contract to install and supply TV, radio and background music systems in each of the hospital's 85 private rooms and associated recreation areas. The high frequency mulitipair distribution system will carry five colour TV channels and four sound channels, including one for Reditune background music.

Each private room will have a special AWA Multipair system 34cm colour TV. They will be suspended on ceiling cradles, allowing full lateral rotation and incorporating adjustable tilting facilities so that the patient's set can be adjusted to the best viewing angle.

By using a switching facility in the nurse call unit, the patient will be able to turn TV, radio, or backgound music on or off, or change channels. The patient will also be able to obtain sound either at the TV set or from a loudspeaker in the handset. None of these operations will interfere with the nurse call facility, which will override the program system.

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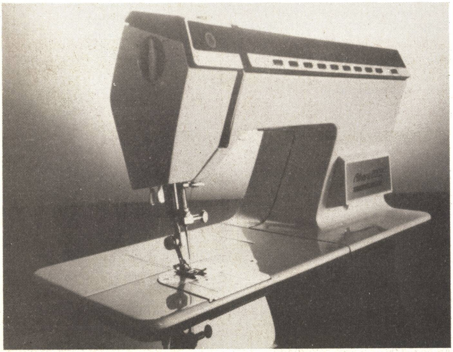
Microprocessor controlled

For many years,there have been great expectations for the use of electronic controls to replace electro-mechanical devices in a range of domestic appliances. Now, with the advent of low-cost microprocessor chips and LSI circuitry, some manufacturers have taken the plunge on the electronic future. In the United States the Singer Company is marketing a microprocessor controlled sewing machine, while in Britain Integrated Circuit Controls has developed two electronic controllers for use in washing machines.

One of the first companies to recognise the potential of microprocessor control in consumer appliances was the Singer Company, which jolted its competitors with the introduction of a revolutionary electronic sewing machine back in June 1975. The new machine was called the Athena 2000 (for the Goddess of Arts), and is claimed by Singer to be the easiest to operate, most foolproof sewing machine ever made.

The culmination of years of development work, Singer's Athena 2000 is the world's first home sewing machine, and one of the first consumer appliances, to use microprocessor control. It represents the first major change in the basic operation of sewing machines since Singer electrified them in 1884.

Programmed into the electronic control system of the Athena 2000 are no less than 24 different functional and decorative stitching patterns. Each pattern is instantly available at the touch of a button. No cam changing or setting of control knobs is necessary.



Singer's Athena 2000, the world's first electronic sewing machine. Solid state circuitry makes this machine easier to operate and maintain than previous models.

In spite of this operational simplicity, the Athena 200 is the most versatile home sewing machine on the US market in terms of both functional and decorative sewing capability. Unique features include a "pattern repeat button" that allows the operator to execute one single decorative unit, a quick-reverse button for instant-reverse straight stitching, a "flip and sew" panel for both flat and in-the-round sewing, and automatic button holing.

Singer claims that the electronic control system in the Athena 2000 replaces more than 350 mechanical parts, including gears, cams, shafts, bearings and bushings. A typical sewing machine, by the way, contains about 700 such parts. In the past, special cam sets were required for sewing decorative stitches, together with devices for adapting stitch length, thread flow and tension to the needs of an increasing range of fabrics.

Naturally, as more features were added to the machine, the number of manual controls, adjustments and accessories increased proportionately. To change from one stitching pattern to another, for example, could require anything up to six basic steps. And while these were easy-to-understand operations, they had to be done in sequence and were time consuming.

A primary aim of the electronic control system then, was to considerably simplify operating procedure.

In the Athena 2000, optimum stitch length, width and density for a variety of functional and decorative stitching patterns are programmed into the electronic control system. On those rare occasions, when required for special tasks, settings can be changed to suit individual preferences or fabric requirements by use of the "individual preference panel." Each stitch starts at the beginning of the pattern, so no practice run is needed.

Heart of the Athena 2000 is a dedicated microprocessor chip supplied by American Microsystems Inc. This chip can store up to 6000 bits of information in read-only-memory (ROM), and controls two linear servos. One servo controls the needle's bight (left-to-right movement); the other controls the back-

electronic sewing machine

and-forth movement of the fabric feed mechanism.

The key to the operating simplicity of the Athena 2000, at least from the operator's point of view, is the stitch selector display panel. Each of the 24 patterns programmed into the microprocessor chip is represented graphically on the panel. A dial is rotated until the desired pattern is centred above one of six control buttons. Pressing that button causes a signal to be sent to the microprocessor, instructing it to generate the pattern selected.

Some appreciation of the machine's operational simplicity can be realised if we consider that the instruction manual for a mechanical model with comparable capabilities runs to 80 pages; the Athena's instruction manual contains just 24 pages.

But the price of this simplicity is not cheap; not with the price tag of the basic model around the $US850 mark for the portable. And if installed in a cabinet, the total cost could be anywhere from $US900 to $US1100, depending upon the cabinet style chosen.

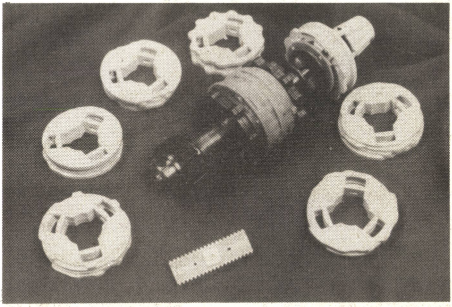
Jack Poggi, President, US Consumer Products Division, defends the high cost. "There are top-of-the-line mechanical sewing machines on the market that sell for more than $US750", he says. "So it is definitely a competitive machine". Certainly, Singer introduced the Athena 2000 with a $2 million national advertising campaign that included prime time on television and advertisements in hundreds of newspapers and magazines.

The campaign was a success, with the order backlog at one stage extending to three months. Singer's Athena 2000 is introducing the consumer to the pushbutton world of microprocessor control.

Washing machine control chips

Meanwhile, in Britain, Integrated Circuit Controls, an associate of Servis Domestic Appliances, has come up with two electronic controllers for domestic washing machines. One of these, designated the "Type 300", controls the wash

Athena 2000 housed in a complete home sewing centre. The specially designed cabinet has a convertible top that slides away for "free arm" sewing.



Athena 2000's control chip together with a selection of cams that it replaces. In all, over 350 mechanical parts are replaced by the electronic circuitry.

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- **0–10MΩ.**

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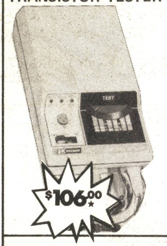

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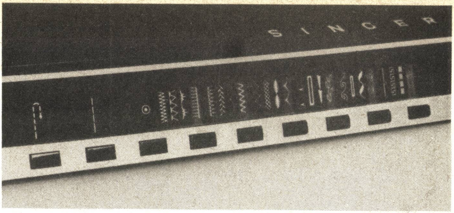

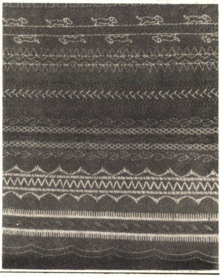

Above: detail of Athena 2000's "Electronic Stitch Selection Panel", showing the variety of stitches that can be selected at the touch of a button. Right: a number of decorative stitches are available in addition to the usual practical stitches.

cycles of Servis' new 7-program pushbutton Selectronic washing machine. The other, the type SCU 150, is an AC speed control unit for electric motors.

The Type 300 electronic controller replaces the complex electro-mechanical switching used previously, and said to be the biggest single cause of machine breakdown. The new controller package provides for motor speed control, temperature control and program timing control, with associated solid state power switching of valves, pump, door lock and heater. Program selection is via a separate front mounted switch panel comprising touch switches and LED program indication.

Heart of the new controller is a dedicated microprocessor MOS timer housed in a DIL 28-pin ceramic package. Main control is affected by means of a ROM, which has the capability of being re-programmed to meet individual customer program requirements. The controller normally provides for up to 8 main programs plus prewash, with three other optional functions.

Surrounding the microprocessor is all the circuitry necessary to provide power supplies, motor speed control, safety features, buffering and power switching. Careful attention has been paid to component selection, packaging and output connections, the latter being minimised so as to provide a simple machine wiring harness. ICC claim that reliability is improved by a factor of 100 with the solid state control system, compared with previous electro-mechanical systems.

The Type 300 control unit can do a lot more than supervise a series of wash programs, however. As Servis are quick to point out, the unit could also be used to run all the equipment in the home, from central heating and air conditioning to cooker and toaster. Main advantage here of course is that while the cost of maintenance of electro-mechanical devices is becoming prohibitive, the electronic controller is inherently reliable.

The other electronic controller in the Servis range, the SCU 150 AC speed control unit, is designed to provide selection and control of the various motor speeds required in an automatic washing machine. This unit is offered as a separate self-contained module, although it would seem that a similar circuit also forms part of the Type 300 controller described above.

The SCU 150 design is based on the use of a high control loop sensitivity; i.e., a high proportional amplification or gain of the error signal, this representing the difference between the actual motor speed and the demanded speed. A triac is used as the power switching element, and this enables a DC out of balance current of less than 10mA per amp of nominal motor current to be achieved.

Servis and its associate Integrated Circuit Controls are playing for very high stakes with their electronic controllers indeed—no less than a dominant position in the European market. In money terms, this market is probably worth in excess of £200 million a year.

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New generation electronic teleprinter

Although teleprinters were first developed around 1906, the basic design has remained unchanged for nearly 70 years. Now with the development of control subsystems based on LSI circuitry, the first "new generation" teleprinters are in production. One such unit is the Siemens Model 1000, a new design that contains virtually no electromechanical devices.

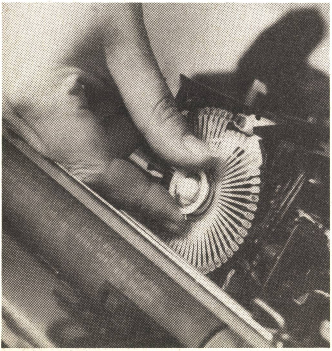
Siemens' "new generation" electronic teleprinter (Model 1000) was introduced to the world market at the 1976 Hanover Fair in Germany. The end product of many years of intensive research and development, it is smaller, lighter in weight and, above all, quieter than conventional machines—a major influencing factor in the "march" of the teleprinter away from the central teleprinter room to individual office locations.

This new teleprinter truly merits the term "new generation" as its entire operation has been converted to electronics. About the only thing that it now has in common with current mechanically-operated teleprinters is that it can transmit and receive signals.

The most conspicuous external characteristic of the new teleprinter is its printing unit. Whereas previously long type levers hammered loudly on the paper, the new system has the print characters accommodated on the ends of the "petals" or spokes of a light plastic disc which is positioned silently in a fraction of a second by a miniature stepping motor. As soon as the stepping motor has correctly positioned the disc, a small hammer presses the selected letter through the typewriter ribbon on to the paper.

Another stepping motor operates the carriage feed, while a third handles the paper feed. The continuously running drive motor, which adds to the background noise of older designs, has been eliminated.

Operating noise has been reduced drastically through this new technique. The noise level of between 48-51dB is less than one quarter of the level of mechanical teleprinters. In fact, the Teleprinter 1000 is considerably quieter than an office typewriter.



The most noticeable external characteristic of the new Siemens Model 1000 teleprinter is its printing unit, which uses petal like plastic spokes rather than metal hammers.

Of course, the most fundamental changes lie within the teleprinter itself. The central control employs seven large scale MOS integrated circuits which have been specially developed for this unit. They are combined on a single PC board that includes all the circuitry required for the control and operation of all modules, as well as the transmitter and receiver.

Various plug-in modules of the Teleprinter 1000 such as answer-back unit, line adapter section and keyboard are connected to the central control via plug-in connections. Tape reader and punch units can be connected via prepared interfaces, and both perforated tape units can be replaced by a magnetic tape cassette unit.

A special feature of the Teleprinter 1000 is the so-called special functions plug-in module. By inserting wire bridges or diodes, more than 50 pre-programmed variations or additional functions like print suppression of specific characters, paper supervision and evaluation of character sequences can be selected.

Internal switches are available for the selection of line spacing, printing force, and telegraph speeds—50, 75 and 100 baud. The electronic keyboard incorporates an automatic "Letters/Figures" shift as well as a "New Line" key providing both carriage return and line feed.

For operators who can type at high speed, the keyboard unit has a buffer store which accommodates characters that have been typed faster than the transmission speed. These are then transmitted at the correct speed to the telex network.

The Teleprinter 1000 requires no preventive maintenance or basic overhaul. The few parts subject to wear and tear, such as the ribbon and the type disc, can be easily replaced by the operator. In the event of a fault the defective plug-in module can be located by using a logical sequence of tests and simply exchanged at the subscriber's premises. A diagnostic unit, the size of a cigarette box, plugged into the central unit, provides additional assistance in trouble locating.

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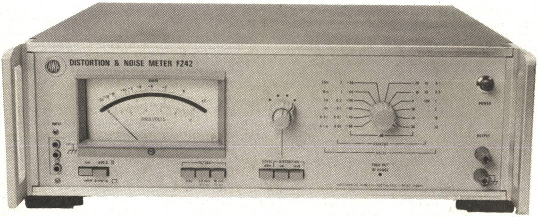

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CSIRO data service makes the most of research dollars

Using a computer to sift information

The information explosion in recent years has presented scientists and research organisations with a new problem—how to locate and retrieve relevant data so that research funds are not wasted on duplication of effort. One way of alleviating this problem is to use a computer-based data search system, such as developed by the CSIRO Information Service.

by ANDREW BELL
Editor CSIRO Industrial Research News.

The story is told of a US industrial laboratory which spent 5 years and $186,000 on research into equipment to translate written material electronically—and then discovered that the work had already been done by Soviet scientists. The results had been published, but the laboratory didn't know.

Today such a mountain of published information exists, such a plethora of reports, abstracts, papers and proceedings that no one can keep up with it. Estimates suggest that two million new scientific and technical papers are now published each year—over 8,000 each working day.

A study published by the OECD noted that information growth has its own built-in accelerating mechanism, independent of other growth factors. By about 1986, according to the study, there will be six or seven times the present volume of information. That means 12-14 million publications a year.

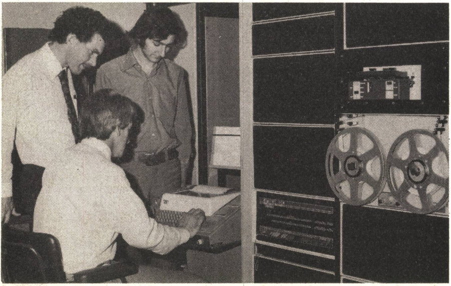
One result of this information explosion is that the time needed to trace a specific item has deteriorated from minutes to hours and occasionally days—if it can be found at all. The community must inevitably pay a penalty, as did that American laboratory, for not being aware of information already available.

Examples of the late discovery of relevant information are, naturally, not frequently reported. However, those that have been documented include the case of a Scandinavian physicist who spent 80 hours in calculating the design of an optical filter before finding out that the problem had already been solved—and that the filter was commercially available.

As long ago as 1958, the Stanford Research Institute in the US estimated that because of inadequate and cumbersome information retrieval, the American economy lost about $746 million a year through duplication of work carried out elsewhere. That represented 9% of total US research expenditure.

Three years ago, the Australian Department of Trade and Industry reported that, in the diffusion of new technology, local industry was penalized by delays, inconvenience and high costs in acquiring information and experience from overseas.

One possible solution is to use the computer. Its ability to sift unerringly

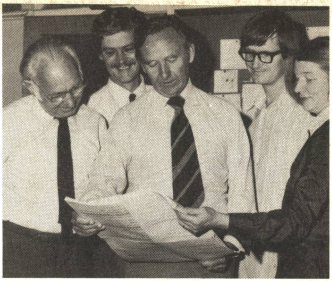

CSIRO Information Service staff programming the computer for a search.

Search profiles — what are they?

The key to finding the wanted gem of information among a myriad or irrelevant items is the 'search profile'. Each subscriber's profile is a set of keywords describing the sort of information he is seeking. The computer is asked to search for these keywords on the tape issued by the abstracting service. Keywords might typically be titles, words or fractions of words, or author's names (there might be up to 100 such terms in a profile).

Certain criteria are applied to the computer's matching of profiles against keywords. If the criteria are met, the reference is retrieved.

It's easier to use the computer to find wanted information than to search through shelves of "Chemical Abstracts".


Mr Clyde Garrow and several staff members of the Information Service in Melbourne inspect a computer print-out.

through huge data banks at a rate far beyond any kind of manual sorting is the counter-offensive to the deluge of information that threatens to swamp us.

The CSIRO Information Service has developed one such computer-based current awareness system that is now available for use by scientists, industrialists and academics. It alerts them to the latest information in their field, saving them hours each week in literature searching.

Called 'Selective Dissemination of Information' (SDI) the system supplies a regular print-out of the latest literature in the field chosen by a subscriber.

SDI scans a wealth of current published information in science and technology. A wide range of 'data bases', formed from magnetic tape versions of abstracting and indexing journals, are searched. This search provides a far wider coverage of the literature than would be possible for an individual to do in the normal course of his work.

Since the service first began working 5 years ago, the core of the system has been 'CA Condensates', the magnetic tape form of "Chemical Abstracts." More than 350 000 entries appear each year, covering papers in chemistry-based serials, reports, patents, conference proceedings and books. The abstracters place a very liberal interpretation on the word 'chemical', so that papers on food processing, fermentation, plant and animal nutrition, enzymes, microbial biochemistry, agricultural chemicals, essential oils and toxicology can all be found.

'CA Condensates' is issued weekly by the American Chemical Society in parallel with the printed issues of "Chemical Abstracts". Each reference on the tape contains all the information that appears in the printed issues except that the abstract is replaced by a set of keywords.

The service has been expanded by adding other tapes so that the fields which can be scanned now include biology, physics, electronics, computers, food, agriculture and water resources.

The tapes are flown from the UK and USA to Melbourne and are searched within 1 or 2 weeks of arrival. The subscriber receives regular postings of relevant references provided on computer printout, made up of detachable 18cm by 10cm 'cards' for filing. Each card usually contains only one reference, although some data bases also provide abstracts printed on a second card.

The computer print-outs are mailed weekly, fortnightly or monthly depending on the service to which the customer has subscribed.

Originally the SDI was available only to CSIRO scientists, but 3 years ago it was

---

There are two types of profiles with different criteria.

A logical profile, looking for information on liquid fuels from coal, for example, might look like this:

Coal	Petrol*
Shale	Oil*
	Conver*
	Hydrocarbon*
	Hydrocrack
	Liquef*
	Liquid*
	Hydrogenat*
(first parameter)	(second parameter)

The asterisk indicates that letters have been removed. So Petrol* will pick up Petrol, Petroleum, Petrology, etc.

When the computer locates an information unit containing a term in the first parameter list, the unit is held and searched for one of the terms in the second. If one of each is present, the reference is retrieved.

Instead of two parameters, it is possible to insist that there be present; alternatively, just one. The more parameters, the greater the precision of the search, but profiles with more than three are rare.

A weighted profile is used when many of the search terms are not very specific and are likely to occur frequently in the data tapes, for example, Analysis, Metaboolism. Each keyword is given a weighted score (positive, negative or zero) according to its relevance to the subject of the search. A particular abstract is then retrieved if the sum of the scores for all the terms located reaches a certain threshold value.

A typical weighted profile, searching for information on pipe coatings, might look like this:

50 *Pipe*	60 *Bitumen*
	60 Coal Tar*
	60 Pitch*
	50 *Coat*
	50 Epoxy*
	50 Lining
	50 Wrap
	10 Resin*
(first parameter)	(second parameter)

If the total score is 110 or more, the reference is retrieved.

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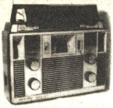

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HALF WAVE GROUND PLANE

Model V1 vertical ground plane (half wave) gain 3.75dB, overall length 5.5m, mounting on mast tubing up to 1½" diameter. $49 + P&P

TRUCK ANTENNA

Twin 50.4" 50 ohm mirror mounted truck antenna. Complete with coax and PL259 plug. $42. + P&P

CB/CAR RADIO ANTENNA

Motorised fully automatic	$55
Lock Down Type	$29

27MHz ground plane, superb quality, wound on strong fibreglass rod with teflon protection. $79

¼ wave high efficiency ground plane, solid 108 inch heat treated radials and radiator. Radials droop for 50 ohm match. Complete with S0239 socket. $35 + P&P $3

FIELD STRENGTH METER
Covers a frequency range 2-200MHz, this handy little meter enables each checking of antenna radiation. $8 + P&P $1

PROFESSIONAL SWR/PWR METER
The new Oskerblock SWR-200B Deluxe is a professional swr bridge using the thru-line principle, covers 3-200MHz, 52/75 ohms. Each unit is individually calibrated. Four power ranges, 2/20/200/2000 watts. $79 + P&P

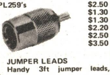
COAXIAL SWITCH

$22

CS201 quality 2 position coax switch. Will handle up to 2.5Kw pep. 50 ohms impedance with insertion loss better than 0.2dB! VSWR better than 1.2 up to 1GHz. Position not selected is automatically grounded.

PLUGS & SOCKETS FOR THE COMMUNICATOR

4 pin mic plugs and sockets (ea)	$2.30
1½' coax jumper leads with PL259's	$2.30
3' coax jumper leads with PL259's	$2.50
PL259 plugs	$1.30
S0239 chassis sockets	$1.30
S0239/RCA adapter	$2.20
"T" connector	$2.50
Lightning arrestor	$3.50

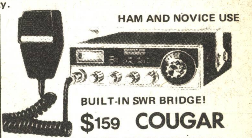


JUMPER LEADS
Handy 3ft jumper leads,

RG58 coax with fitted

PL259's	$2.50
18" version	$2.30

HAM AND NOVICE USE



BUILT-IN SWR BRIDGE!

$159 COUGAR

COUGAR 23 B AM DELUX TRANSCEIVER

Delux mobile 23 channel (synthesised) for the quality conscious Novice. The Cougar features built-in swr meter, noise blanker, delta tune, rf gain control, mic gain control, built-in modulation meter, separate PA switch. Circuitary consists of 1 IC, 20 transistors, 18 diodes. RECEIVER: dual conversion, sensitivity 0.5 uV for 10 dB S+N/N, selectivity 6 dB bandwidth 5 kHZ, PA audio power 5 watts. TRANSMITTER: 5w input, spurious harmonic suppression better than 55 dB.
Comes complete with mic, mobile bracket, dc cable and manual.

POPULAR VC2 SWR/PWR METER
The popular VC2 covers 3-150 MHz with power measurement 12/120 watts. Will handle up to 1000w. 50 ohms impedance, twin meters. This quality tru-line instrument is ideal for the shack or for permanent mobile installation.
$36 + P&P

$36 SWR/PWR METER

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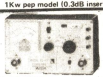
$20

Superb quality low pass filter (32MHz cut-off) for transmitters 1.8 thru 30MHz. Insertion loss under 0.5dB, input/ output impedance 50 ohms. Complete with S0239 sockets. Will handle 200w pep (max) $20 + P&P $2
1Kw pep model (0.3dB insertion loss) $34 + P&P $3

27MHz TEST SET



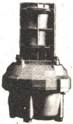
$55

Model FS-117 has built-in wattmeter and 5 watt dummy load, measures swr, modulation, field strength, crystal activity. Ideal for home repairs and "tweeking".

AIGA ROTATOR SPECIFICATIONS SUMMARY

MODEL NO.	ART-8000	ART-3000A
Rotating Torque	2,500kg/cm	850kg/cm
Braking Torque	10,000kg/cm	1,700 kg/cm
Maximum Vertical Load	2,500kg	250kg
Control Accuracy	± 5°	± 5°
Drive Type	Gear	Gear
Power Requirements	(May be modified upon request.)	
Operation Temperature	−40°~ +80°C	−40°~ +80°C
Forward/Reverse Delay	3 seconds	3 seconds
Maximum Continued OP	20 minutes	3 minutes
Mast Clamp	48 φ ~ 78 φ	34 φ ~ 55 φ
Cable Requirement	9 conductor	8 conductor
Net Weight	26kg	5.7kg
Shipping Weight	27.5kg	6.5kg

ART-3000



ROTATOR

NEW

ART3000C Heavy Duty	$189
ART8000 Super Duty	$450

VICOM

Head Office & mail orders . . .
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Prices include sales tax but exclude freight and insurance. For insurance allow $1 per $100, min $1. Freight sent Kwikasair (freight "collect") unless otherwise specified. Prices and specifications subject to change without notice. The law requires that a licence must be held for all transmitting equipment.

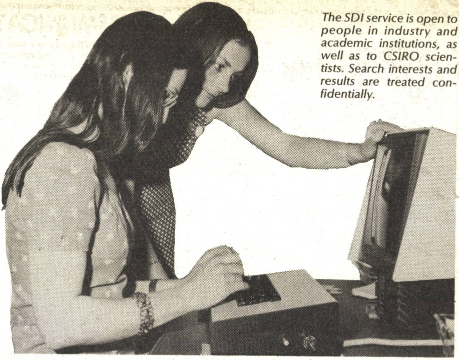
Information sifting

opened to anyone who wished to participate. There are now over 300 subscribers to this current awareness service, including some in New Zealand. The list may soon include South-east Asian countries. About half the subscribers belong to CSIRO, while the remainder are about equally divided between industry and academic institutions.

The Manager of the CSIRO Information Service, Mr Clyde Garrow, emphasizes that SDI can be used most effectively by scientific and technological specialists who have the library back-up necessary to procure the references—some of them obscure—uncovered by SDI. He also likes it known that each subscriber's search interests and results are treated confidentially.

While the current awareness work of SDI answers the question 'What's new?', there is another side to this work which seeks to answer the question 'What's known about so-and-so?'. Retrospective searching provides references to information on a subject covering a period of years and is particularly useful at the start of a new research project or for a review of literature on a specific topic.

This service is very popular. Although having become available only this year, 500 retrospective searches have been carried out in the last 6 months. These searches are provided from on-line interactive information retrieval services operating in the USA. The search request is telexed to CSIRO's Washington office; retrieval references are air-mailed back to Australia.



The SDI service is open to people in industry and academic institutions, as well as to CSIRO scientists. Search interests and results are treated confidentially.

In addition to using the overseas data bases, the Information Service has developed a number of uniquely Australian information banks.

"CSIRO Index," containing information on CSIRO research publications, has been converted, for the period after 1969, to machine-readable form. Computer access is now also available to "Australian Science Index", a file of references to scientific and technical information published in Australia.

Recently, the Information Service collaborated with the Australian Mineral Foundation to establish the "Australian Earth Science Information System". It contains references to Australian material in geology, minerals, exploration, mining and related fields.

The usefulness of the search—how many relevant references it misses and how many irrelevant ones it supplies—depends on the aptness of the search profile (see box). An inexperienced user some time ago asked for all the information on the corrosion of metals—the first week's delivery was a foot thick! For this reason each new profile is constructed with the aid of an information specialist from the CSIRO Information Service. He also supervises the initial test of the profile and monitors its performance when it is running on a production basis. For all this, the cost to the subscriber is modest. At present charges range from $30 to $200 a year for current awareness and average $15 for a retrospective search yielding 50 references.

As well as computer sifting of scientific publications, the CSIRO Information Service has also begun to build up numerical data banks which list various properties of materials. The three currently available are in the fields of powder x-ray diffraction, mass spectroscopy and thermodynamics. As an example of these, the latest, on thermodynamics, is described in the accompanying box.

And if you still find the computer can't solve your problem, then you'll welcome the Information Service's inquiry and referral service, staffed by 11 scientists and engineers. Although they receive 15,000 enquiries a year, there's not many they can't answer, either directly or by referral to someone who can.

Interested readers can obtain further information by contacting the CSIRO Information Service, PO Box 98, East Melbourne, Vic 3002. Telephone 419 1333. Also at 175 Liverpool st, Sydney, NSW 2000. Telephone 211 3400.

What is Thermodata?

Thermodata is the latest scientific data bank to become available through the CSIRO Information Service. It contains a listing of the thermodynamic properties of more than 3000 inorganic compounds.

However, it is more than a set of numbers. Given any list of chemicals, Thermodata will calculate what reaction will take place when they are mixed. Thus, given the left side of a chemical equation, Thermodata will supply the right side. It will also supply the yield and heat release of the reaction if the quantities and temperatures of the reactants are specified.

Such information is invaluable in the design of any new chemical or mineral processing plant. Applications so far have included calculation of flame temperatures and heat release in the submerged combustion of slags, a feasibility study of a new process for the recovery of sulphur from pyrites, the rate of vapour deposition in the manufacture of semiconductors and optimization of a tin smelting process.

Thermodata was developed by Dr Alan Turnbull of the CSIRO Division of Mineral Chemistry. Information on the use of the system is available from him.

The data in the bank is up-to-date and has been carefully checked for self-consistency. The largest section was provided by the National Physical Laboratory in England and consists of experimental data for enthalpy, entropy and heat capacity of 1600 inorganic compounds and 200 dilute solutions. Dr Turnbull provided data on another 500 inorganic and 700 organic compounds, and he plans to enlarge the bank even further. (Dr Turnbull's address is: Division of Mineral Chemistry, PO Box 124, Port Melbourne, Vic. 3207.)

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Increasingly advanced recording techniques mean that near perfect sound is available to the music lover. To fully appreciate this sound, you need equally sophisticated reproduction equipment. And that's what Dokorder is all about!

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PHOTIMPORT

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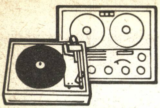


Hi Fi News

2MBS-FM CHANGES FREQUENCY —AND MAKES A POINT!

Sydney's community-owned music broadcast station, 2MBS-FM, has changed frequency from 92.1MHz to 102.5MHz and re-sited its antenna to the top of the AMP building at Circular Quay—at present the city's tallest building. Behind these changes lies a story—and a lesson!

by NEVILLE WILLIAMS

When it was originally given the go-ahead to put a station on the air, the Music Broadcasting Society was allocated a frequency of 92.1MHz as being one of the few which slotted into the international FM band (88-108MHz) and between existing VHF television allocations, without too much trauma.

It was understood that the new station, 2MBS-FM would initially broadcast a relatively low-power signal in mono, using vertical polarisation. It would change over later to stereo-multiplex, up the power of the transmitter and instal a horizontally polarised aerial with a more directive pattern giving it a much stronger and more wide-ranging signal.

Station engineers, many on a voluntary basis, have been working for a long time towards this ultimate goal, but with more than their fair share of frustrations.

The change to stereo-multiplex was effected successfully some time ago. However, progress towards the use of a higher power transmitter, to other than vertical polarisation, or to a higher gain antenna at the existing transmitting site on the PMG's West Street tower was halted by the fear that the signal might create havoc with Departmental electronic equipment on the site.

2MBS-FM might have accepted the situation more stoically had it not been for the commencement of the FM/stereo service by the Australian Broadcasting Commission in 92.9MHz. While 0.8MHz is a quite significant separation in the normal way, the vital difference was that the new ABC service came on with a high power transmitter and a horizontally polarised gain-type antenna, sited on top of the Channel 2 television mast.

The disparity in signal strength was just too much for some FM tuners in some areas, and many complaints were received of interference by the ABC with 2MBS programs.

A seemingly obvious course would have been for 2MBS to seek permission to diplex its transmitter output into the same antenna, or else to mount its own antenna on one of the three large TV masts in the North Sydney area. Unfortunately, all such approaches proved abortive for at least two likely reasons:

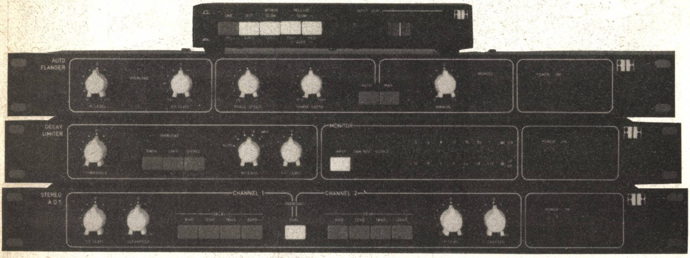
1. There is a limit to the amount of mass and wind loading that can be imposed on a tower, and
2. Until it is clear who is going to get FM licences in the re-planned system, owners of the towers or facilities are not keen to enter into arrangements which they may later regret.

Failing access to the television towers, 2MBS engineers did the rounds of tall buildings on Sydney's north shore looking for some other possible site for their transmitter and antenna, Again there were two strong reasons for concentrating on the north shore:

The first was the obvious one that, to ensure good audience coverage, the antenna should be sited in the area to which most directional antennas are pointed, whether they are specific FM antennas or TV antennas with a split-off to the FM tuner. Particularly when one is transmitting FM/stereo there is good reason to plan for a strong signal and one that is not compromised by multiple-path reception.

The second reason was more subtle, arising from the fact that the 2MBS frequency of 92.1MHz is a sub-multiple of the television channel 7 allocation 181-188MHz. It is therefore a potential source of interference into receivers tuned to channel 7, either by a directly radiated second harmonic, or by the generation of such a harmonic within the receivers or their immediate environs.

The problem was not seen as an urgent



A complete new range of Allen and Heath production aids for radio and recording studios, P.A. installations, etc is now being distributed in Australia. The units, which have fully balanced input and output facilities and proven performance, include a Mini Limiter, Auto Flanger, Feed Forward Delay Limiter and a Stereo Automatic Double Track Unit. For further details apply: Optro Pty Ltd, 17 Arawatta St, Carnegie, Vic.

one as long as the 2MBS antenna remained reasonably close to the channel 7 tower, because the television signal would always be strong enough to swamp the interference. However, moving 2MBS to another area could create a zone in its immediate vicinity where the spurious harmonic effect would be strong enough to compete with the television signal, causing obvious interference.

As it transpired, 2MBS was not able to locate a suitable site—or at least they could afford to exploit—and they were trapped. Worse than that, the authorities who controlled the West Street tower had found it necessary to ask them to vacate even that site.

The way out of the dilemma came with a decision to move the Newcastle television transmitter from channel 5 (101-108MHz) to channel 5A (137-144MHz). While there are still TV transmitters on channel 5 elsewhere, reallocating the Newcastle service cleared the way for 2MBS-FM to shift to a new frequency of 102.5MHz corresponding to channel 273.

On this new frequency, 2MBS-FM was out from under the TV channel 7 interference problem and was able to pursue other sitting options which finally led it to the top of the AMP Centre.

Because its occupancy of the West Street tower had already over-run the period of notice, 2MBS-FM engineers had to make the transfer at very short order and before the new site had been properly evaluated. The existing 400W transmitter was therefore removed from service and retuned hastily, then installed on top of the AMP Centre with a vertically polarised antenna.

A new higher power transmitter and the higher gain horizontally polarised antenna are to follow and the station engineers have their fingers crossed.

The transmitter will be sited in a highly developed business area, packed tight with computers and other electronic equipment. How much of it will be swamped by a high power broadcast transmitter?

And what of all the many base stations for mobile services that are (or will be) sited on the AMP Centre or nearby buildings? Will they too be swamped? Past design conventions have accepted that base station equipment may be co-sited with other base equipment of similar power, but a high-power broadcast station is quite another matter.

As pointed out in the station's associated journal "Stereo FM Radio", the whole experience emphasises the need for a single, suitable site to be created in Sydney from which FM stations—particularly those with a limited budget can radiate.

Similar problems will undoubtedly occur in other cities.

One thing is certain, the tribulations of 2MBS-FM are going to be re-enacted again and again as and when new groups get the green light to set up FM stations.

Haco Distributing Agencies, marketers of National products in Australia, have announced the release of an extension loudspeaker with in-built power amplifier. With a power rating of 4 watts and two drivers, a 16cm woofer and a 5cm tweeter, it is intended to take its output from the earphone socket of typical cassette players, TV receivers, etc, providing extra power for a barbecue area, rumpus room or for the benefit of those with a hearing disability. (Haco Distributing Agencies Pty Ltd, 57 Anzac Parade, Kensington, NSW.)

COMING: 9kHz SPACING

Still on the subject of broadcasting, the die has definitely been cast for a reallocation of Australian AM broadcast station frequencies on the basis of 9kHz separation, instead of the present 10kHz. The decision is largely the outcome of considerable pressure on the administration from a number of directions, both inside and outside Australia.

Hifi news briefs:

RISING ELECTRONICS, a new name in the local hifi scene, is situated at 4 Wewak Place, Allambie Heights, NSW 2100 (Tel 02-93-2922). In a letter to "Electronics Australia", General Manager V. J. Vozzo points out that his company is marketing an unusual, if not unique, line of tape equipment which can play either 8-track cartridges or compact cassettes in the one mechanism.

Manufactured in Osaka, Japan, by the Hokuyo Musen Kogyo Co Ltd, the Rising model CTC-702 is a car stereo cartridge/cassette player, with AM and FM/stereo radio, available immediately in Australia. Also listed is the CTC-700, without the radio facilities.

For use inside the home, three units are listed: a cassette/cartridge player, a cassette/cartridge player with AM and FM/stereo radio, and a cassette recorder/player with AM and FM/stereo radio. Inquiries should be directed to the address given earlier.

PHOTIMPORT: For many years, the name Photimport has been associated, for most people, with high quality cameras, projectors and other photographic equipment. Now the company is becoming heavily involved in the audio/hifi field.

A batch of leaflets to hand nominates them as Australian distributor for the well known Dokorder tape equipment and a fold-out leaflet shows a round half-dozen open-reel models covering the field from domestic to professional.

Other leaflets detail speaker systems by Mirsch and by Castle Acoustics Ltd, the latter bearing the strong stamp of British design and manufacture.

And, finally, there is Lenco, a name once associated mainly with turntables but now offering a cassette player as well, combined player/amplifiers, a 3-in-1 music centre, loudspeakers, phones and accessories. For details: Photimport (Australia) Pty Ltd, 69 Nicholson St, East Brunswick Vic 3057, and in other capitals.

B&O OFFER: Notable for its slim Danish styling, Bang & Olufsen hifi equipment is all the more appealing when it is made the subject of a special order. During a recent visit to Australia, B&O's regional export manager Mr. S. E. Pedersen announced details of a new extended period offer: The top-of-the-line Beogram 4002 turntable (with electronically controlled tangential arm) is available now for $638. Originally priced at $760, it would have risen to $970 with devaluation but for the special offer. (For details: Danish HiFi, 698 Burke Road, Camberwell Vic, tel (03) 82 4839.

AURIEMA/DBX: Auriema (Australasia) Pty. Limited is mounting a four day mini-show of its American designed products to mark the release of three new models from DBX Inc. and a new electret cartridge from Micro-Acoustics Corporation. The promotion will be staged at the U.S. Trade Centre, 37 Pitt St., Sydney from June 3rd to 4th inclusive. The opening times will be Wednesday to Friday 12 noon to 8 p.m. and 10 a.m. to 4 p.m. on Saturday.

Lencoclean L as shown optional extra

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Photimport presents with pride, the Lenco range of precision-engineered Hi-Fi turntables. Australian test results have shown that wow and flutter are almost impossible to measure in Lenco equipment! So, people who are looking for near-perfection in sound reproduction . . . listen to Lenco. Combine this superb reproduction with Lenco's very reasonable price and you have a very sound bargain!

Three superb Lenco turntables.

Model L90

The L90 Lenco Electronic Hi-Fi. A superb, top-ranking belt-driven transcription turntable. 16-pole synchronous motor, illuminated strobe, dampened spring suspension and anti-skating device. As precise as a Swiss watch.

Model L65

The L65 Lenco Automatic belt-driven Hi-Fi turntable. Light aluminium tone arm. After selection of record diameter, tone arm lowers itself onto the record. After playing, it returns itself to tone arm rest. Viscously dampened suspension. A high quality instrument for excellent reproduction.

Model L60

The L60 turntable, precision engineered for great sound reproducton! Manual operation, but with all other advanced features of the L65. The L60 . . . the way to get renowned sound reproduction at a moderate price.

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HIFI NEWS—continued

While Australia reputedly has more broadcast stations than any other nation outside the United States, there is a strong clamour for still more stations, partly to better serve the more remote areas, and partly in the form of low-power communal broadcasters to meet the domestic needs of urban zones, and of ethnic and special interest groups.

For many years the now defunct Australian Broadcasting Control Board kept the lid on new station applications on the grounds that the Australian community is already well served and that the addition of further transmitters, sharing channels already occupied, would prejudice the coverage of those stations already in operation.

Renewed demand for more stations, evident at the McLean Inquiry into FM broadcasting, prompted the Australian Broadcasting Control Board to spell out a possible alternative approach to frequency allocation on the medium-wave band: Less emphasis could be placed on exclusive channels and large potential night-time coverage for key stations; more transmitters could be authorised, on the assumption that their signals needed to remain intact only within planned and limited coverage areas.

But, of course, broadcast band signals cannot be fenced in as tightly as that and there is a limit to what can be achieved in channel sharing by merely "fiddling" present-day allocations, manipulating power limits and the use of directional transmitting antennas.

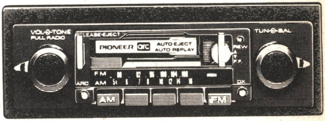
Additionally, Australian authorities have to consider night-time interference into and out of adjacent nations, notably New Zealand on the eastern seaboard and Indonesia on the west.

It was not surprising, therefore, that discussion of such problems at the last ITU (International Telecommunications Union) conference should have led to the decision that countries in Region 1, and in Region 3 (which includes Australia) should reallocate broadcast band frequencies on the basis of 9kHz separation.

In fact, a provisional guide sheet to the proposed new Australian frequencies is already in existence and, within a couple of months, stations will be preparing for the change and arranging tests at appropriate times in cooperation with those authorities who have to implement the new scheme. One station, 6PM in Perth, has already shifted frequency to minimise a problem with an Indonesian transmitter but, for the most part, all stations will stay on their present frequencies until a target changeover date in November 1978.

When the change is affected, most individual stations will merely shift one way or the other by up to 4kHz, so that the

AM/FM RADIO, CASSETTE PLAYER



Pioneer have sought to minimise the hassle in car sound entertainment with their new KP-8001 AM/FM-stereo radio cum cassette player. The on-off switch can automatically extend or retract a powered antenna, while the tuning push-buttons will operate on either AM or FM-stereo. Other refinements include a local/distance switch and an automatic noise limiter circuit. Special facilities simplify tape handling. (For further details: Pioneer Electronics Australia Pty Ltd, 178 Boundary Rd, Braeside, Vic 3195.)

Technics presents its credentials
Linear Phase speakers

An excellent example of Technics continuous research policy is these two linear phase speakers. The SB6000 and the SB5000.

Linear phase speakers, in general terms, means reproduction of the original incoming signal faithfully and without "brightness" or "colour." In other words, sound that is pure, clear and with all the "zing" and "punch" of the original sound track.

After all the better your speaker, the greater your listening pleasure.

And that's why, for the very discriminating and knowing audio enthusiast, Technics presents the SB6000 and the SB5000.

SB6000 Linear Phase 2-Way 2-Speaker System

- The 30 cm woofer gives low distortion through the low to midrange frequencies.
- The 3.2 cm dome tweeter gives high efficiency and low distortion.
- 100 watts peak power input.
- 92 dB/W (1m) sound pressure level.
- Dimensions (WxHxD): 425 x 846 x 340 mm
- Weight: 28kg

SB5000 Linear Phase 2-Way 2-Speaker System

- A popular version of the linear phase speaker system series.
- The woofer is wide-range 25 cm.
- The 6 cm wide-range edgeless cone tweeter delivers crisp high frequencies.
- 75 watts peak power input.
- 93.5 dB/W (1m) sound pressure level.
- Dimensions (WxHxD): 350 x 717 x 323 mm
- Weight: 16kg.

National Technics

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Victoria Office: 103 Pelham St., Carlton 3053. Phone 347 7620.

majority of listeners using ordinary tunable receivers will not notice much difference, if any. A few stations will have to be reallocated quite different frequencies and, of course, people using push-button tuners will have to re-peak them.

The other group to be affected will be hifi listeners who, over the years, may have equipped themselves with wide-range AM tuners having a 10kHz whistle filter. Under the new arrangements, the fixed inter-carrier heterodyne will drop to 9kHz—for many a somewhat more audible frequency—and the filters will have to be retuned, hopefully by screwing the slug in by a couple of turns.

Listeners with wide-range tuners will also probably notice a slight increase in "monkey chatter" because of the greater proximity of adjacent stations. It is unlikely, however, that the actual audio bandwidth as transmitted will be reduced significantly, if at all. For those interested in wide-range AM reception, continued enjoyment will depend on retuning the whistle filter and whether or not the wanted local signal is strong enough to swamp out vestigial sideband interference from adjacent transmitters.

But the vast majority of listeners will remain blissfully unaware of these subtleties, because the vast majority of AM receivers cut off well below 9kHz anyway!

THE RECORDING MARKET: Figures publised a few weeks ago by the Australian "Financial Review" give an interesting indication of the size of the local market for commercial recordings:

"Record imports grew from three million discs in 1971-72 to a peak of seven million discs in 1974-75, then declined to five million discs in 1976-77.

"(When looking at these figures it must be remembered that these include the import of records by the record companies for local release.)

"Over the same period local record production has grown from 21.5 million discs to a peak of 27.8 million in 1974-75 and tapered off marginally in 1975-76 to 27.7 million discs.

"Over the same period imports of tapes have remained relatively static while local production has increased markedly.

"In 1971-72 1.2 million tapes were imported, peaking to 1.8 million in 1974-75 and tapering off to 1.5 million in 1975-76.

"Local production, on the other hand, has gone from nil in 1971-72 to 4.7 million units in 1975-76."

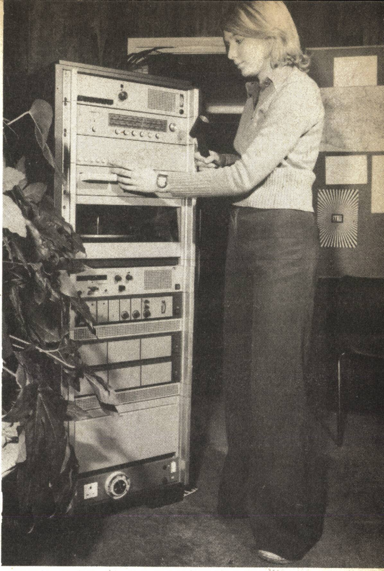
While these figures indicate that the recorded music industry in Australia is alive and well, they do spell trouble for the record boutiques which have tended to specialise in imported pressings and cassettes.

The downward trend evident in the total imports has since been accelerated by rising prices overseas, the effect of devaluation of the Australian dollar, and the demand for local copyright payments, irrespective of the overseas copyright charges. These rising costs have put the imported article at a disadvantage, particularly in the face of more speedy local releases and improved quality of their presentation.

While there is no likelihood of the imports drying up altogether, the market would seem to be shrinking towards the specialist buyer, whose needs are simply not being met by those albums which can reasonably be produced in Australia.

THE "JAPANESE SOUND": According to Nigel Cowan of Rose Music Pty Ltd, the term expressed an early prejudice fostered by the fact that Japanese speakers were optimised for Japanese homes. But things have changed, and Nigel is willing to back the latest Yamaha range—8 systems—against the big-name American brands.

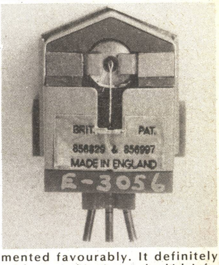
As the electret capacitor microphone undergoes continuing development, it is penetrating further into fields once dominated by conventional capacitor and dynamic units. The new 1776 electret by Electrovoice is rugged, has a response to 18kHz with a natural bass emphasis when used close-up, a cardioid pattern, and a notably high output voltage. (Electro-Voice Inc, 600 Cecil St, Buchanan, Michigan 49107 USA.)



Distinguished by the number of major units in the range, and by the number of sub-modules available, amplifier equipment by the Millbank Electronics Group Ltd, of Sussex, England, can be assembled into rack mounted installations to meet a wide variety of needs in supermarkets, hospitals, conference centres, auditoria, etc. Millbank are represented in Australia by R. H. Cunningham Pty Ltd, of 493-499 Victoria St, West Melbourne 3003.

Decca London cartridge has "positive scanning"

While most magnetic cartridges look alike and use the induced magnet principle, this is not the case with the Decca London cartridge. It uses the ''moving-iron'' principle and has vertical and lateral coils connected in ''sum and difference'' mode. Here we review the new Mark 6E model, which has a major improvement in tracking force compared with the superseded model.



The appearance of the Decca London is unorthodox. As our photograph shows, you can see pole-pieces and one of the coils. The stylus pivot is buried somewhere towards the top of the cartridge. The stylus assembly is designed with a forward tension which necessitates the use of the tieback thread. These two factors combine to eliminate any tendency to fore and aft movement, which presumably explains the term "positive scanning."

In spite of its unorthodoxy, the external appearance of the Decca can hardly be rated as impressive. With a combination of red moulded plastic and crimped metal construction, its looks are not a match for its price. This is a pity because there must be a considerable amount of precision entailed in its manufacture.

The elliptical stylus is a square-shanked "naked" diamond which can be very accurately set on the pivot system. Tip mass is less than one milligram.

While the stylus may look vulnerable, the cartridge is provided with an effective stylus protector in the form of an overall cover. Also, it is possible to detach the cartridge from its terminal block-cum-mounting foot so that it can be assembled into a headshell without hazard to the stylus.

Tracking force range is from 1 to 2 grams with the recommended figure being 1.5 grams. We certainly agreed with this figure. At this tracking force the cartridge handled our standard tracking test on the W&G 25/2434 with no problems and also performed very well on the Shure "Audio Obstacle Course" disc.

Cartridge inductance is 560 millihenries in each channel, and Decca note that it cannot be used for playback correction. This is a consequence of the "sum and difference" connection in which the lateral coil is common to both channels. Cartridge inductance was used to help provide bass equalisation in many early preamplifier designs, especially those using germanium transistors. This was because they were deficient in "open-loop" gain.

While many amplifiers, even some of quite recent design, have preamplifiers in which the negative feedback networks produce undesirable interaction with the cartridge inductance, there would be few to which the foregoing paragraph would apply.

Recommended load for the cartridge is 50k but Decca do not mention the effect of shunt capacitance on the frequency response. Our observation was that cable capacitance should be kept to a minimum to obtain the most linear response. Accordingly, our test was performed in a tonearm suitable for CD-4 operation, having a cable capacitance of 100pF in each channel.

Most tonearms provide four leads for connection to the cartridge. This gives rise to a problem with the Decca cartridge, which has only three output terminals. One has to experiment with connection of the tonearm leads to obtain the lowest hum output. Even so, the hum output was higher than we have come to expect. We are not sure whether this was due to a compromised connection or to hum induction into what must be an inherently less well-shielded coil system than is obtained with other cartridge types.

Frequency response of the cartridge, checked out with the CBS STR 100 disc, was flat within ±1dB from 20Hz to 12kHz. Above this, the response rose to a broad peak of ±6dB centred on 16kHz in one channel while in the other channel the corresponding peak was only +2dB. Separation between channels ranged from −22dB in both directions at 1kHz to −13dB at 12kHz and diminishing rapidly above that.

Waveform of the cartridge was relatively poor, with all sorts of high frequency ringing effects. Square response also showed pronounced ringing at high frequencies.

We fully expected the cartridge to sound undistinguished, based on the above results. Instead, we were most impressed with the clean sound it produced, especially on the inner grooves of discs. All who heard it commented favourably. It definitely produces a subjective result which is far above what the objective tests predict.

As such, the Decca London is sure to have a keen following—not only because of its excellent sound quality and good tracking ability, but because of the mystique which is sure to arise when objective and subjective results do not agree.

Recommended retail price of the Decca London cartridge is $125, from selected hifi retailers. As the stylus is not removable for replacement, the distributors have an exchange cartridge service for $48.

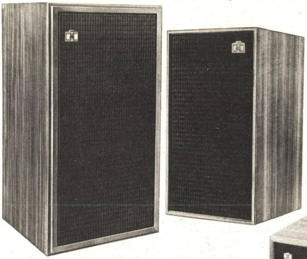
Further information on the Decca London may be obtained from the Australian distributors, British Merchandising Pty Ltd, 49-51 York Street, Sydney, NSW 2001. (L.D.S.)

Everyman should have his Castle...

KENDAL & RICHMOND.

The Kendal (left) and Richmond (right) are both bookshelf speakers and are of the new generation reflex systems based on recent scientific analysis of loudspeaker low frequency loading–and what a difference they make!

With a power handling capacity of up to 25 watts per channel RMS. The braced cabinet is constructed of 15 mm and 18 mm high density chipboard, hand-finished with selected wood veneers and protected with a final coat of tough polyurethane lacquer.



Castle Acoustics
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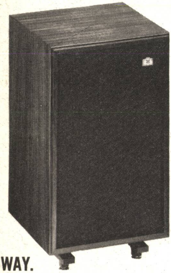
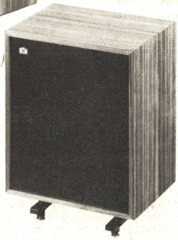
FROM ENGLAND
THE HOME OF QUALITY LOUDSPEAKERS



HOWARD.

A five-speaker three-way system designed for the connoisseur of sound quality and craftsmanship.

The Howard has a power handling capacity of 50 watts per channel RMS. Size: 26″ high x 19″ wide x 15″ deep and weighs 56 lbs.



CONWAY.

A high quality, floor standing, three-speaker three-way system intended for the average room and for use with medium powered (25-50 Watts per channel) amplifiers.

Designed primarily as a loudspeaker of exceptionally good performance, the Conway is also a piece of high quality furniture.

The beautifully finished contemporary style cabinets are available in Walnut with and without stand.

CASTLE 8RS DD.

The Castle 8RS DD is a highly sensitive eight inch unit covering the frequency range from about 50Hz (depending on cabinet size) to 20 kHz.

Suitable for use with good quality stereo systems, tape recorders, car radios, public address and background music systems.

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A rugged stereo power amplifier in kit form

Dynaco Stereo 150

Dynaco is a name well-known and respected on the Australian scene for loudspeaker systems. Less well known is the fact that they produce some highly rated kits of high fidelity equipment, such as the Dynaco stereo 150 power amplifier reviewed here.

KIT EVALUATION
by LEO SIMPSON

In spite of the overall popularity of complete stereo amplifiers or receivers, there is still a large demand for separate power amplifiers, tuners, control preamplifiers and other equipment. One reason for this is that there are few complete stereo amplifiers or receivers with power output of more than about 100 watts per channel.

But while a high power system may be desirable to many, the fact that they are usually based on separate units rather than integrated equipment means that they can be very expensive. So any approach which allows the would-be enthusiast to obtain a high power system at reasonable cost is likely to be eagerly considered. And one of the few available approaches at a reasonable cost is the Dynaco stereo 150.

The Dynaco Stereo 150 is a rugged, conservatively rated basic power amplifier.

Rated power of the stereo 150 is 75 watts per channel into 8 ohm loads and 100 watts per channel into 4 ohm loads. With these ratings the amplifier lies at the low end of the range of high power amplifiers, but it is such a massive-looking brute that it will figure in many buyers' considerations.

Only the most basic facilities are provided on the Stereo 150. On the front panel is a large rocker switch for power and a pilot light. On the back panel, which is largely occupied by some aggressive-looking heatsinks, there is one pair of input sockets for RCA phono plugs and two pairs of terminal posts for loudspeaker connections. There is also a pair of fuses for loudspeaker protection.

The two power amplifiers may be strapped together internally to make a single 150 watt (into 4 ohms) mono amplifier. Just why anybody would want to do this we have not been able to figure out. As will be seen from the performance figures, it would be a rather pointless exercise.

Design of the power amplifier circuits is along fairly conventional lines. Direct coupling is employed throughout, apart from the input coupling capacitor. The input stage is a differential pair, T1 and T2 driven by a constant current source T3. T3 provides good ripple rejection while the adjustable emitter load enables the offset voltage at the output of the amplifier to be set close to zero.

Most of the voltage gain of the amplifier is provided in the class-A stage, T4. This has a tapped collector load, 3.3k and 5.6k, with bootstrapping applied from the output stage via a 50uF electrolytic capacitor.

The signal from the class-A stage is coupled via 100-ohm limiting resistors to the complementary-symmetry output stages. T9 plus T11 and T10 plus T12 form Darlington pairs which are connected as emitter-followers. These provide close to unity voltage gain and considerable current gain.

While most power amplifiers have a single transistor connected as a "Vbe multiplier" to set the output stage bias conditions, the Dynaco has a different set-up. Two transistors T5 and T6 are interconnected to provide the same function and presumably superior thermal compensation. On the PC board, T5 is thermally connected to the driver transistors T9 and T10.

T7 and T8 and their associated diodes and other components form a protection circuit for the output transistors. Dynaco state that it is a "volt-amp limiter circuit" but it appears more like a simple current limiting circuit.

T7 monitors the current across the 0.33 ohm emitter resistor for T11 and reduces the base drive to T9 if the current exceeds a critical value. Similarly, T8 does the same job for T10 and T12. The diodes across T11 and T12 protect these transistors against inductive kickback when the protection circuit operates.

An unusual form of thermal overload protection is employed. Instead of using a thermally operated cut-out, a thermal sensor mounted on the heatsink monitors the temperature of the output transistors in each channel. If the temperature rises above 75 degrees Celsius, the thermal sensor shunts away some of the input signal to the amplifier.

Presumably the "thermal sensor" is some form of thermistor. As such it is a fairly modest system of protection. The amplifier would have to be really abused for the thermal protection to operate. For example, it would have to be grossly overloaded with the heatsinks poorly ventilated.

Certainly our stringent "power soak" tests did not cause the thermal protection to operate.

If this reviewer had been responsible for the design, he would have preferred to specify thermal cut-outs. Then if the amplifier is abused, the cut-outs operate and draw attention to the abuse.

A really rugged power supply is employed in this Dynaco amplifier. In fact the same sized power supply could probably drive a much higher power amplifier. A centre-tapped bridge rectifier circuit and two 10,000uF 85VW electrolytic capacitors provide plus and minus 50-volt DC supply rails which have inherently very good regulation and low ripple output.

As a kit the unit is supplied packed in a cardboard carton with plenty of styrofoam pack polystyrene foam padding. Within that carton are smaller boxes containing the transformer and other major components plus lots of small envelopes containing small parts. These have to be checked off against the parts list in the manual.

That is where the Australian kit-builder strikes his first hurdle. The many screws and nuts have American numbering, which bears no relationship to screw sizes and types in Australia. The problem is not insurmountable but recognition of these unfamiliar screw types would be made easier with a pictorial diagram depicting each type of screw.

From there on the constructor is led through a detailed step-by-step procedure. The experienced constructor is tempted to leap ahead to hurry up the job, but that can easily lead to mistakes. For that reason, we found the unit a little frustrating to build. But a novice would no doubt be grateful for the detailed procedure.

Even so, we think the unit is unnecessarily complicated to build. On the one hand, Dynaco save the builder a lot of work and potential frustration by supplying an assembled and tested PC board for the power amplifiers. But on the other hand there still seems to be quite a lot of point-to-point wiring and mechanical assembly

For example, the power supply PCB assembly uses a double-sided PC board to accommodate two small sockets, four resistors, two ceramic capacitors and four fuses. The bridge rectifier is not accommodated on the PCB but is mounted on the PCB bracket with wires run to it. And why are the diodes across the output transistors wired across the transistor sockets, rather than installed on the main PCB?

Other examples of this seemingly unnecessary complication abound. It makes little difference to the effectiveness of the circuit design, but it must have more than a small effect on the price.

Do not jump to the wrong conclusion, though—this kit is not difficult to build. Anyone who can solder can successfully build it. No doubt about that. Just follow the step-by-step procedure.

One feature we did like was the pretinned hook-up wire. Because it is pretinned with solder the strands do not easily separate when the insulation is stripped off. This makes it easy to cut and strip the many separate wires to length, and to solder them into circuit.

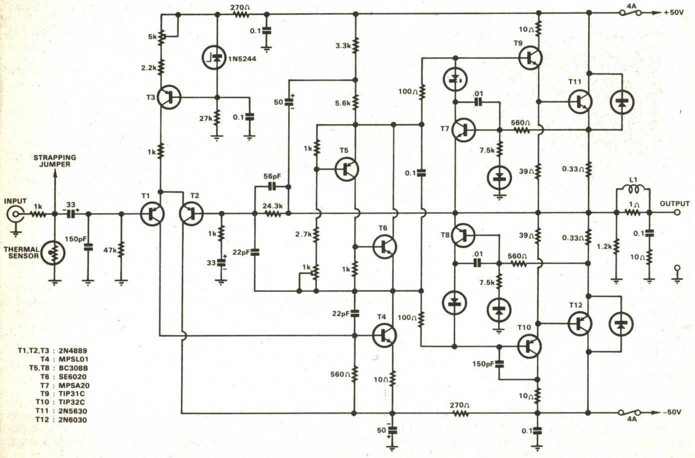
A three-core flex with moulded three-pin plug for 240VAC operation has been added to the kit by the local distributors. They have also produced a suitable addendum for the assembly manual—good. We were a little concerned, however, at the way in which the mains wiring is exposed when the top cover of the amplifier is removed.

In normal use this is no problem, but it might present a hazard to the hobbyist when making adjustments or tests on the amplifier. We would suggest that the mains neutral and transformer wires be terminated to an insulated terminal block instead of the tagstrip supplied. It would also be wise for the constructor to put some electrical insulation tape over the mains fuse and switch, at least as a temporary measure, while tests are performed.

It is a good feeling to finish assembly of an amplifier, check your work and then turn the unit on and find everything goes as it should. There were no hassles with our sample and no need to make adjustments for offset voltage or quiescent current. It is at this time that the somewhat tedious assembly procedure seems all worthwhile. And this feeling was reinforced when we put the finished unit under test.

Single channel ratings for the Stereo 150 are 130 watts into 4 ohms, 90 watts into 8 ohms and 45 watts into 16 ohms, all at less than 1% harmonic distortion.

The circuit of the Dynaco Stereo 150 is direct-coupled and features a boot-strapped complementary-symmetry output stage.



DYNACO STEREO 150

For stereo operation, the specification is more stringent at 75 watts per channel into 8 ohms and 100 watts per channel into 4 ohms with both channels driven and for a rated distortion of less than 0.25% anywhere between 20Hz and 20kHz.

Our measurements yielded a result of 55 watts per channel into 16 ohms, 93 watts per channel into 8 ohms and 132 watts per channel into 4 ohms, with both channels driven. With one channel driven, the results were 58 watts into 16 ohms, 102 watts into 8 ohms and 156 watts into 4 ohms.

Harmonic distortion for the above results was typically less than 0.05% over the whole audio band, and the only time it rose above 0.1% was at full power into 4 ohms where it rose to 0.15% at 10kHz. These distortion figures substantially agree with Dynaco's typical distortion curves, and point up the conservatism of the rated distortion figure.

And the generous power output points to further conservatism on Dynaco's part. Now, in the light of the figure of 156 watts into 4 ohms, the purpose of strapping the two power amplifiers together seems needless. No more power output would be gained—although it would certainly spread the power dissipation equally across the four output transistors.

Separation between channels, with respect to 90 watts into 8 ohms was 48dB at 10kHz, 65dB at 1kHz and 79dB at 100Hz. Signal to noise ratio was 100dB with respect to 90 watts into 8 ohms. There are no clicks or thumps from the speakers at switch-on, although there is a subdued thump a few seconds after switch-off.

Frequency response at the −1dB points was 10Hz and 30kHz. Square wave response was good with a slewing rate of 10V/uS. We did notice a slight burst of RF oscillation superimposed on high amplitude sine waves when the load was shunted with capacitances ranging between 3300pF and .01uF. However, it was at a very low level (relative to the audio output) so it is not a problem.

With its large heatsinks the amplifier runs cool for most of the time. Even when run at maximum power dissipation conditions it does not become unduly hot.

Since transient intermodulation distortion is a consuming interest of many hifi buffs these days, we decided to test this amplifier for signs of it, even though Dynaco do not make mention of it in their literature. At present, there is no quantitative test tor TID so we applied the more-or-less standard test for TID: apply a fast rise-time square wave signal to the input, adjust amplitude for high output, and then examine the signal in the early stages for signs of overshoot and/or clipping. The Stereo 150 passed this test with no signs of trouble.

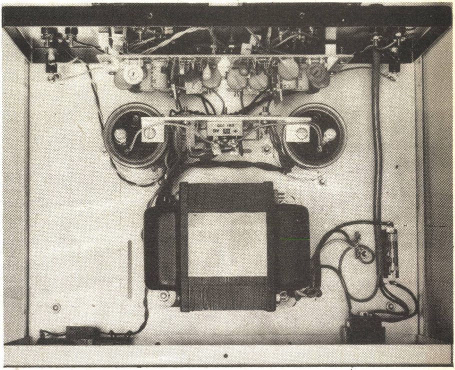
Note that the fuses in series with the output are rated at 3 amps. At this value the amplifier will deliver full power on program material. During our tests we blew them so we increased the value to 5 amps, reasoning that the fuses in the power supply rails provide the ultimate protection to the amplifier. Normally the output fuses should be 3 amps or less, to suit the loudspeaker.

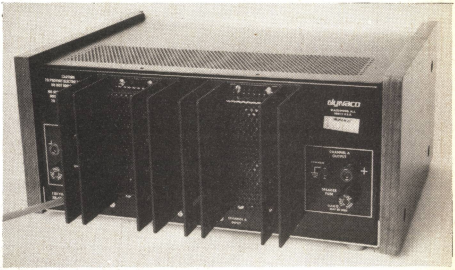
From the total of these results it can be seen that the Dynaco stereo 150 is a high quality amplifier, conservatively rated and with ample power. Since its sound quality is largely determined by the equipment with which it is teamed we can make no subjective assessment. Nor do we need to.

We would like to see an option for a loudspeaker protection-cum-muting circuit, as found on many other high power amplifiers. The only option presently available for the Stereo 150 is a set of panel meters plus associated circuitry.

Price of the Dynaco stereo 150 kit is $399 including tax or $469 completely assembled. The local distributor or appointed dealers also offer a check and repair service for $20 which includes any parts replaced but not, presumably, freight.

Further information on Dynaco products can be obtained from the Australian distributors, Harman Australia Pty Ltd, 271 Harbord Road, Brookvale NSW 2100.





Loudspeakers

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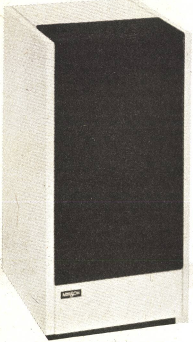
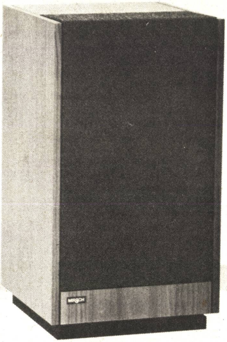
MIRSCH OM 3-28



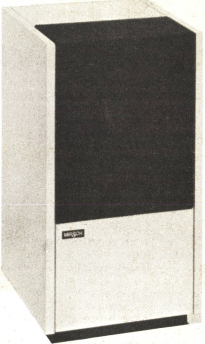
3-way, 3 speaker system.
Principle: Infinite baffle.
Power Handling Capacity:
50 watt RMS.
Frequency Response:
35-20,000 Hz.
Impedance: 4 ohm.
External Measurements:
51 x 32 x 25 cm.
Walnut or White cabinet.

MIRSCH OM 3-38



3-way, 3 speaker system.
Principle: Infinite baffle.
Power Handling Capacity:
90 watt RMS.
Frequency Response:
30-20,000 Hz.
Impedance: 8 ohm.
External Measurements:
56 x 32 x 31 cm.
Walnut cabinet.

MIRSCH OM 2-21



2-way, 2 speaker system.
Principle: Infinite baffle.
Power Handling Capacity:
40 watt RMS.
Frequency Response:
40-20,000 Hz.
Impedance: 4 ohm.
External Measurements:
46 x 29 x 25 cm.
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PA 23M

Build our new Playmaster—

3-75L HIFI SPEAKER SYSTEM

Described here is a build-it-yourself loudspeaker system which should have a strong appeal to the many constructors of the Playmaster Twin-25 and the Playmaster Forty/Forty stereo amplifiers. With good frequency response and power handling capability, it requires little more for its assembly than some open floor space and a screwdriver!

by NEVILLE WILLIAMS

The system, as pictured, was made up from a prototype kit which we were able to organise in cooperation with Dick Smith Electronics and their cabinet suppliers. By the time this article appears in print, you should be able to purchase complete cabinet kits and complete speaker kits from all Dick Smith outlets, and a little later from those other suppliers who choose to take up the project.

Nor will you need to be an electronic genius to put it all together. It should be a breeze for any handyman (sorry, for any handyperson!) who can read and follow simple instructions. We gather that a wiring loom will also be available, obviating even the need for soldered joints.

With precision-cut panels and a convincing simulated wood-grain surface, the finished enclosures will lose nothing by comparison with commercial systems—with the modern plastic fibre grille in position, or removed to show off the drivers!

And we think that you'll like the sound quality as much as you'll like the appearance. It can be adjusted to suit your kind of room and your kind of music and we'll back it against many of the systems in hifi showrooms carrying a much higher price tag.

One other thing: you don't have to buy the complete kit. If you fancy yourself as a cabinet maker and want to create something that will merge with a particular decor, you can work to the dimensional information given and simply buy the loudspeaker kit, or as much of it as you need.

But, before we get involved in constructional details, how did this new system come into being? Our answer to that question reflects the changing local scene as it relates to home-built loudspeaker systems.

Ever since publication of the two very successful Playmaster amplifier designs—the Twin Twenty-Five and Forty/Forty—there has been a constant stream of inquiries about loudspeaker systems to go with them.

Some have ultimately settled for commercial systems, some for one or other of the Philips Elcoma kits, some for our own Playmaster 3-41L system described in June last year, and some for still other combinations. But, inevitably, there have been others to whom none of these propositions have appealed. The system they seemed to be looking for could be summarised something like this:

- Wide frequency range including sustained bass; good power handling capability; not too expensive.
- Not less than three drivers, with the bass driver a 12-inch unit, in keeping with the current hifi fashion.
- Compact enclosure.

Unfortunately, not all these requirements can be easily reconciled. In the first place, complementary sets of high-performance drivers in an adequate enclosure are not likely to come too cheaply, remembering that we are talking about regular catalog lines—not fortuitous one-time clearance bargains.

Again, 12-inch woofers do not mate easily with smallish enclosures—50 litres or thereabouts. Cone resonance shoots up from 30-odd Hz to around 90Hz, yielding plenty of "bomp" but not too much fundamental bass below 60Hz.

It's okay for pop sound but disappointing for the hifi devotee who likes to listen for the big drum and the big pipes. And this observation applies not just to home-built systems; it is a common failing of many commercial systems which try to accommodate too large a cone in too small a box.

Another problem facing the would-be system designer is the virtual disappearance from the market of quality Australian-made drivers. Some brands and models have disappeared altogether; others are in very short supply. We're not implying that Australian-made drivers are necessarily better than the imported article but we could compare notes with their designers and we could confirm continuity of supply for as many retailers as cared to handle them.

That position no longer holds. Every supplier seems to have a different mix of drivers on their shelves: left-overs from Australian production runs, random stocks of current models, and imported drivers of just about every shape and size—which may be good, bad or indifferent.

One of the companies most keen for us to describe a new Playmaster system was Dick Smith Electronics and, with almost no encouragement at all, they came up with a whole array of sample drivers—all possibilities, with and without supporting data, but none of them automatic choices.

And, if you don't appreciate the bewilderment and frustration of trying to settle upon one optimum combination from such an assortment, try it sometime! It's okay if you have nothing else to do for a month or more but it's a chore-and-a-half if you have to fit it in with other activities!

Two things did become immediately obvious, however:

The first was that we had to think in terms of a sealed enclosure. Ported systems are fine when the design can be optimised and adhered to strictly. They are much less attractive when the driver is basically too large for the enclosure and also subject to possible change or substitution if the supply dries up.

The second point was that none of the available 12-inch woofers offered good fundamental bass, when shut up in a too small enclosure, filling and damping notwithstanding. All showed a system resonance between 80 and 100Hz and all were down by 8dB or more at 50Hz.

The conclusion was obvious enough:

If constructors wanted a 12-inch woofer to show off, and good fundamental bass as well, they would simply have to accept a larger enclosure. But there would be a bonus:

A larger sealed enclosure, partially filled with absorbent material would accommodate much better to other similar low resonance woofers if substitution became necessary at some later date.

But how large could an enclosure afford to be?

At this point, we turned the question back to people who actually have to sell systems, and to those who make up cabinets and cabinet kits. How large a cabinet will typical hifi enthusiasts accept? And, following from this, what precise dimensions will cut economically from present-day metric sized sheets of pre-surfaced particle board?

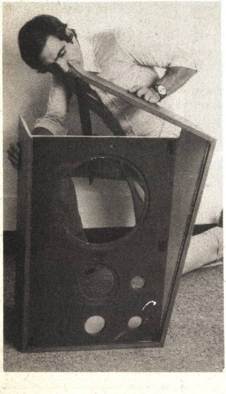
What came out of their deliberations was an enclosure as pictured measuring some 717mm tall, 475mm wide and 293mm deep. Allowing for the thickness of the particle board (17mm) and some set-back of the baffle, the internal volume works out at just over 75 litres—the kind of figure we had in mind and in the same league as that chosen by Philips-Elcoma for their own 12-inch sealed systems.

In such an enclosure, properly sealed and filled, a typical 12-inch low resonance woofer can be expected to exhibit a broad resonance at about 60Hz, with output well sustained down to 40Hz or below. So far, so good.

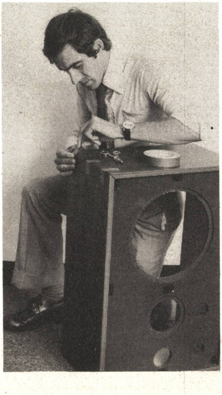
There followed the problem of mating whatever woofer we might choose with one of a number of possible mid-range drivers (they call them squawkers!) and one of a number of possible tweeters.

Our measurements on the woofers, done by a close-field mic technique, indicated differences in sensitivity of between 5 and 9dB in various parts of their operating range. Assuming that similar differences would be found between the various squawkers and the various tweeters, it became painfully evident what differences in frequency response

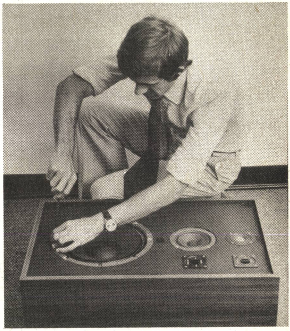
Having thoroughly wetted all the mating surfaces with PVC adhesive, the enclosure walls are folded around the baffle as shown in the lower left picture.



E.A. staff member Greg Swain shows, below, how the final joint should be held tightly together with good quality adhesive tape. In the prototype enclosure, the level controls were on one side of the baffle. In the production run they will mount one to either side.



At right: when mounting the drivers and level controls be doubly careful not to let the screwdriver slip.



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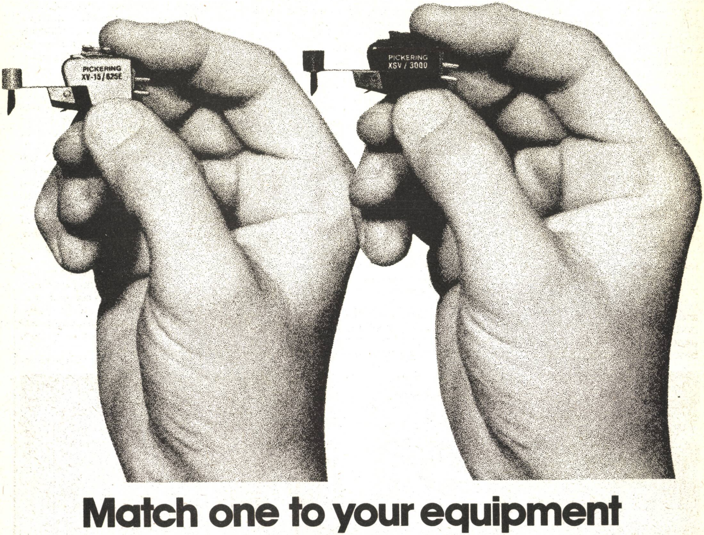

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contour—and colouration—could result from the many possible permutations and combinations.

Add to this the other qualities of the drivers and uncertainties about price and continuing supply, and we faced an exercise which we didn't relish!

It was at this point that our attention was drawn to a 3-speaker kit available from Japanese sources and identified there under the "Nisco" brand. Available with it was a modest pre-fabricated frequency dividing network, and sensitivity controls fitted to mounting plates and branded "Mid Range" and "High Range". The system had immediate eye appeal and, in this respect, held a lot more commercial promise than what might have resulted from combining one of these, one of those and one of something else!

More to the point, the Nisco system sounded very well in the 75 litre box and, after a number of A-B tests with other likely combinations, we felt that no good point would be served by pursuing the latter any further. We would be only too happy to hand them all back and follow through with Nisco!

But what would the supply position be for the Nisco kit?

Inquiries in Japan by Dick Smith Electronics established that any number of sets of speakers, prefabricated networks and wire-wound controls could be imported into Australia, though possibly under another brand name—for reasons best known to the manufacturers! Dick Smith Electronics could sell them as kits of speakers, or with enclosures as complete system kits, or to other retailers through the Dick Smith wholesale outlet.

We gather, in fact, that it is open to any company to import Nisco speakers direct, if they have the necessary resources to do so.

Actual data on the Nisco system is limited but the woofer is branded 80W maximum, 40W nominal. Having respect to this and its construction, it would appear to be a very appropriate transducer for either the 25W or 40-watt Playmaster amplifier. Sensitivity is quoted as 95dB and is about average for a high performance woofer. On our measurements it appeared to be virtually identical in this respect to the big Philips woofer AD 12100/W8.

It is reasonable to assume that the squawker and tweeter have a power rating to match that of the woofer—in their own spectrum, of course—but their sensitivity would appear to be somewhat higher, despite a very flat overall curve published by the manufacturer. When connected directly to the drive via the divider network, they tend to produce a prominent, although not harsh, middle and upper register, resulting in what has often been called the "Japanese" sound.

Sufficient to say that, when the aforementioned potentiometers are installed and turned to "level" they introduce just about enough mid and treble attenuation to give an overall balance very close to a hifi optimum—in our judgment. In fact, we settled for slightly less than that again, resulting in an overall balance very similar to that of the Philips System 14 in concrete, which we tend to use in our laboratory as a known and substantially uncoloured reference.

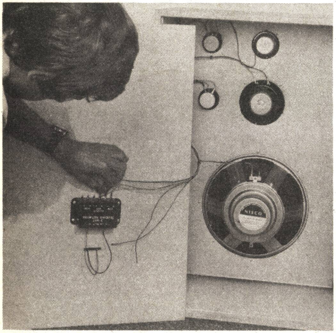
But the potentiometers certainly do their job. Turned right down, the sound is quite mellow. Turn them up and you can summon all the "presence" you are ever likely to want for solo voice or solo instrument.

Compared with many other 3-way systems, the frequency dividing network suggested and available is a relatively simple design—a series inductor for the woofer, series capacitor and inductor for the squawker and a further series capacitor for the tweeter.

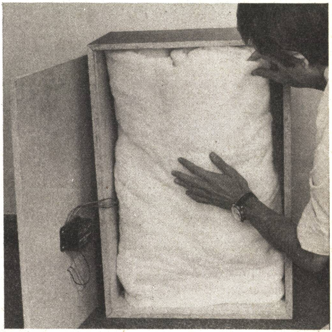
And here we had to face a choice: We could accept the network which was immediately available at modest cost, or we could get involved in the kind of development that seems inevitably to lead to complex circuitry, difficulty with the procurement of components, and the addition of quite a few dollars to the cost of a stereo pair. Having listened again to the sound, and after checking to make sure that the iron-cored inductor did not prejudice the low frequency waveforms, we decided to stay with the simple system.

Turning now to the enclosure, we understand that Dick Smith Electronics plan to market their pre-cut and prepackaged timber kit in stereo pairs, because that is what most people will want. Single packaging would be less efficient and more costly.

Following what is now common prac-



Originally, we mounted the divider network centrally on the back panel, but mounting it to one side allows a more natural run for the wiring around the internal filling. Make sure that you follow the diagrams exactly, observing the "+" and "—" markings on the drivers, the network and the output connector.



The inside faces of the enclosure are not padded but the internal space should be occupied by "Innerbond" or other similar filling. Cut a 70cm strip, 3 metres long, roll it from both ends like a scroll and stand it on end as shown, being careful not to dislodge the connecting leads as you push it in.

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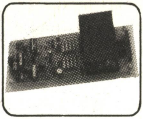

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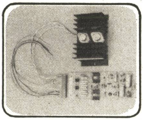

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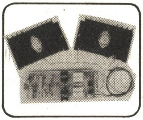

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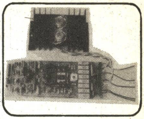
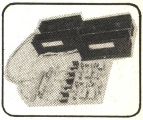


027 250 Watt R.M.S. power amplifier module c less than 0.2% T.H.D. Fully short-circuit protected. 8 OHM balanced output. $113.28



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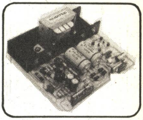

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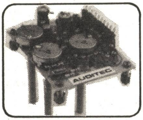
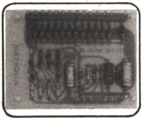
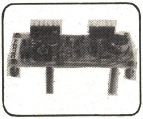


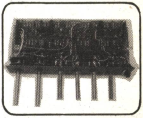
016 Twelve channel active mixer module. Combines outputs of 015 and 029 modules up to a total of 12. Output 1V. $10.78



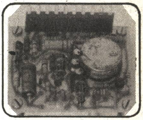
006 Headphone/V. U. Meter Amplifier. Drives high impedance headphones and all types of V.U. meter. Also provides master gain for mixers. Operates at 1V line level. $14.21



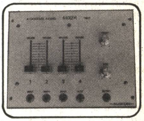
1036 Very high quality stereo complete preamplifier. Provides all normal facilities and gives superlative performance to match that of the 033 module. $89.19



029 General purpose preamplifier. Same as 015 Mk.2, Module, but without bass and treble controls. $10.75



1031 Complete four channel mixer. Inputs 0.5mV, 5mV, 100mV, on each channel. Output 1 volt. Bass and Treble controls overall with slider volume controls. $57.44



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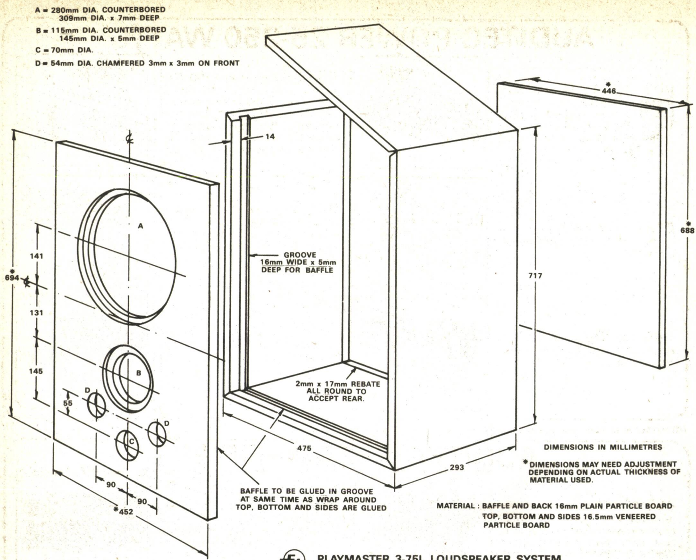

A = 280mm DIA. COUNTERBORED 309mm DIA. x 7mm DEEP
B = 115mm DIA. COUNTERBORED 145mm DIA. x 5mm DEEP
C = 70mm DIA.
D = 54mm DIA. CHAMFERED 3mm x 3mm ON FRONT
14
*446
*688
717
GROOVE 16mm WIDE x 5mm DEEP FOR BAFFLE
A
141
*694
131
145
B
D
55
C
D
90
90
*452
2mm x 17mm REBATE ALL ROUND TO ACCEPT REAR.
475
293
BAFFLE TO BE GLUED IN GROOVE AT SAME TIME AS WRAP AROUND TOP, BOTTOM AND SIDES ARE GLUED
DIMENSIONS IN MILLIMETRES
*DIMENSIONS MAY NEED ADJUSTMENT DEPENDING ON ACTUAL THICKNESS OF MATERIAL USED.
MATERIAL : BAFFLE AND BACK 16mm PLAIN PARTICLE BOARD
TOP, BOTTOM AND SIDES 16.5mm VENEERED PARTICLE BOARD
1/SE/-

EA PLAYMASTER 3-75L LOUDSPEAKER SYSTEM

Here are dimensional details of the Playmaster 3/75L enclosure, as it comes in kit form, ready for "wrap-around" assembly. Note that it is drawn in the upside-down position in which it should be put together. A handyman carpenter building an enclosure from uncut sheets should work to the external dimensions, using internal cleats as necessary. The baffle and back panel dimensions would need to be modified to become a slide-in fit.

tice for such enclosures, the sides, top and bottom are cut fom one strip of pre-surfaced particle board. 90-degree grooves are milled where the joints will be, leaving the segments held together only by the imitation timber grained surface finish. An additional rectangular groove is milled to take the front baffle. When adhesive is run into the grooves, and the sides, top and bottom are folded around the baffle, a rigid, potentially air-tight enclosure is formed.

While the surfacing material provides a surprisingly effective "hinge", allowing the panels to be folded and unfolded, we suggest that you don't tempt fate by idly demonstrating to yourself or to anyone else how it all goes together. Leave that until you are ready to do the job.

Before starting, make sure that you have available a large tube of PVC adhesive ("Aquadhere" is fine), some adhesive tape, and clear space on the floor covered with paper, in case you spill some glue. Oh, yes, and a scrap of clean cloth to wipe off any surplus.

Open the cabinet timbers full length on the floor and tentatively stand the baffle, tweeter end down, in what will ultimately be the top of the enclosure. The idea is that, when the panels are folded around it, the join where the two outer ends ultimately meet will be at the bottom, resting out of sight on the carpet. Remember also that the rebated side of the baffle is the front face.

Having worked out how everything will fit together, put the baffle aside and apply adhesive to all the 45-degree surfaces and to all surfaces of the rectangular slot for the baffle. Apply enough adhesive so that, when spread with a finger, it will wet all surfaces thoroughly and evenly. Wet the butt edges of the baffle all around and, for good measure run a thin extra line of glue in the bottom of each V and in the bottom of the rectangular groove.

This done, slip the baffle into position, tweeter end down and rebated face to the front, without pushing it too hard into the groove. Now fold the sides and bottom carefully up around it, allowing the baffle to slip into its natural position, without straining either "hinge". Bump the panels into place with the ball of the hand, bringing the two free edges tightly together. Hold them in this position with as many strips of adhesive tape as seem necessary.

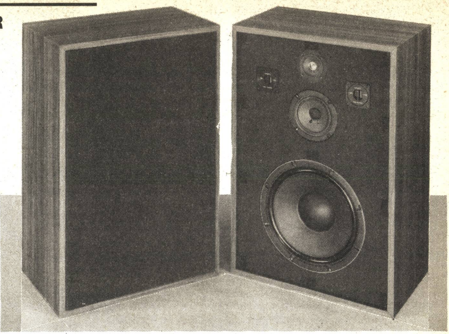
Wipe away the surplus adhesive which will have been squeezed from the joints and put the enclosure aside overnight for the joints to set hard.

The second enclosure can be assembled in a similar manner.

If you want to be doubly fussy, prop the two enclosures so that they are resting on the edge that you have to hold closed. Run a line of glue on the inside of the join, bridging the side and bottom.

The next logical operation is to mount the loudspeakers. It isn't a difficult task but be careful how you handle the

3-75L HIFI LOUDSPEAKER SYSTEM—continued



Your finished Playmaster 3-75L loudspeaker systems will look like this, with the mid-range control on the left and the high range control on the right. Velchrome pads, stapled to the surface of the baffle, hold the grille material in position. The grille material can, in fact, be lightly sprayed to any desired colour using a pressure type spray can.

As virtually the final step in assembly, the rear panel can be glued in place. If you have time and energy to spare, the panel could be stiffened by glueing and screwing a transverse cleat to the inner surface, as also might the front baffle, but neither measure is essential.

speakers and the tools, otherwise you may end up with a finger or a screwdriver through a cone.

You will need about two-dozen 8-gauge by 19mm self-tapping screws to mount the woofers and squawkers, about sixteen 6-gauge by 16mm self-tapping screws to mount the tweeters and crossover networks and the same number of smaller countersunk head woodscrews for the level controls.

It is essential to drill pilot holes for the 8-gauge screws, marginally smaller than the core of the thread to minimise the risk of splitting the particle board. Angle the holes very slightly away from the cutout edge for the same reason.

There is a temptation just to put the cabinet on its back, drop the speakers in place and drill through the holes. If you do, you'll probably end up with chips clinging to the sticky cone surround, compromising the appearance of your woofer for ever after. Lay the speakers in position—they should drop neatly into the rebate—mark the holes with a pencil and remove the speakers before drilling. Make sure, for the sake of appearance, that the holes are symmetrical in relation to the baffle centre line.

There remains the problem of how particular one should be about sealing around the drivers and level controls.

With precision woodwork, everything should seal reasonably well if just screwed into position but there is the risk of spoiling the ship for the traditional half-penny worth of tar.

Three possibilities come to mind, all of which we have seen used.

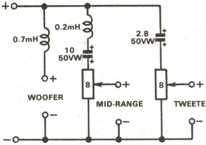
The simplest is to screw the woofer and squawker into place with the cabinet on its back, then to run a thin line of the PVC adhesive in the space between the rebate and the edge of the housing. For the tweeter and controls, smear the surfaces which will mate with adhesive, screw them in place and leave to set. The adhesive will seal fine but, if you ever have to remove any of the items, you will have to break the glue seal and you will leave behind a rough surface—ridges of hard glue and holes where the glue has pulled out the particle board fibres.

Another possibility is to roll non-hardening caulking compound into a string, as uniform as you can manage, and to tuck it into the corner of the rebates and around the edge of the cutouts for the tweeter and controls. Tighten them down against the caulking and part off any surplus that squeezes out, using your screwdriver blade like a putty knife. The art in using caulking compound is to apply it evenly so that it spreads uniformly under pressure—not a lump here and nothing at all somewhere else!

A third possibility which we prefer, is to apply a gasket to the supporting face of the rebate, using a strip either of adhesive-backed felt or adhesive backed foam (e.g. Engel's no. 5C draught excluder, sold by hardware stores). Use this also to back the tweeter. The controls can be sealed in the same way or again with caulking compound. Incidentally, poke holes through the foam before attempting to drive the screws; if you don't the foam may catch in the thread and be dragged out of position.

COMING: the 3-53L

Designed for those who must use a more compact system.



Circuit details of the cross-over network. Note that the level controls are constant impedance pads, not ordinary potentiometers. System impedance does not fall below 7 approx. ohms at any setting. Nominal crossover frequencies are 1500 and 5000Hz.

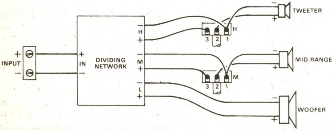
Another important point: tighten the screws into the particle board just to the point where they "nip". Apply more pressure than that and you stand to strip the hole.

Now move to the rear of the cabinet and install the wiring. If working with a prepared harness, it will involve only pushing clips on to the appropriate tags. Otherwise, you may have to cut your own leads and use soldered joints. Either way, make absolutely sure that you identify the "plus" leads on all drivers (stamped "+", red paint spot or red washer) and effect the ultimate connections as shown in the wiring diagram, including that to the external tagstrip.

If not already marked, designate the plus connector on the outside of the enclosure, so that both loudspeaker systems can be connected symmetrically to the amplifier.

We screwed the filter network to the back panel as pictured in keeping with the manufacturer's suggestion. With the benefit of hindsight, it would have been simpler to screw the network to the bottom or one of the side panels, and extend the pair which runs to the external connecting lugs. As it is, you'll have to manipulate the Innerbond filling into position without dislodging any of the connectors.

For the Innerbond (or equivalent bonded fibre acoustic material), we suggest you cut a strip 3 metres long by 70cm wide and roll the two ends like a scroll, so that it will be self-supporting. If you have any scraps left over, lay them lightly in the bottom of the cabinet under the woofer.



For those who are unsure about reading a circuit, here is a wiring diagram. If not using a prepared wiring loom, make the connections with hook-up wire not less than 10/0.10, using different colours to minimise confusion.

This done, the back can be inserted and glued in position—a rather final act because, thereafter, any access to the enclosure will have to be gained through the loudspeaker holes. It would, of course, be possible to add internal cleats and screw the back down against a felt or foam gasket, but this should be quite unnecessary. The chances are that you'll never need to get inside the enclosure again.

Assuming that you follow the intended course, lay the enclosure face down and wet the entire rebated surface with PVC adhesive, without leaving any surplus behind. Also wet the edges of the rear panel and press it into position. For good measure run a thin line of adhesive around the space between the two, leaving the enclosure face down until the adhesive has hardened.

Finally, stand your enclosure the right way up, wipe off any signs of your toil, press the foam grille into place and the job is done.

You've just got yourself a pair of speakers that will mate perfectly with that new amplifier!

FOOTNOTE

While we did no original work on the crossover network, home-made inductors could be based on those mentioned in our June 1976 issue. For the larger inductor, make up a non-metallic bobbin with a 25mm dia centre and 50mm cheeks 20mm apart. Wind on 165 turns of 18B&S or 19SWG for an inductance of about 0.7mH. The 0.2mH inductor can have 90 turns on a similar bobbin. Alternatively, the 0.2mH can be wound on a moulded bobbin (RCS Radio) originally intended to slide on to a ¾ × ¾in core and measuring 1-7/16 across the faces. Wind on 105 turns of the wire specified.

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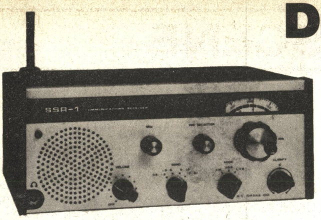
Brisbane 31 2896
Perth 21 7885

TK/11



Drake SSR-1

Communications Receiver

- Synthesized
- General Coverage
- Low Cost — around $290
- Selectable Sidebands
- All Solid State
- Built-in Ac Power Supply
- Excellent Performance

The SSR-1 Receiver provides precision tuning over the short wave spectrum of 0.5 to 30 MHz with capability of reception of a-m (amplitude modulated), cw (continuous wave) and ssb (upper and lower single side band) signals.

A synthesized/drift-cancelling 1st mixer injection system giving thirty tunable ranges from 0.5 to 30 MHz is derived from a single 10 MHz crystal oscillator providing frequency stability necessary for ssb operation.

A stable low frequency VFO tunes each of the 30 one-MHz ranges with a dial accuracy of better than 5 kHz which is sufficient to locate and identify a station whose frequency is known.

Separate detectors (product and diode) are used to provide for best performance whether listening to ssb or a-m signals. Narrow band selectivity for ssb and wide band selectivity for a-m reception is provided.

A manual tuned preselector provides for maximum sensitivity and maximum interference rejection.

Solid state circuitry throughout allows efficient operation from built-in ac power supply internal batteries or external 12 V-dc source.

FRONT PANEL CONTROLS

MHz: Sets the MHz range of the received frequency. This control tunes the smaller inner dial (1) and is adjusted for the center of the desired MHz range.

Signal Meter: Indicates relative rf input signal level.

Pre-selector: Adjust receiver rf tuned circuits for proper reception of signal. This control is tuned for maximum signal or noise at the selected frequency.

Frequency Display: Indicates tuned frequency.

The inner dial indicates MHz range and the outer dial indicates kHz reading. As an example 5.750 MHz.

kHz: Tunes the kHz range of the receiver. This control turns the large outer dial (2) and is adjusted for the proper frequency as displayed on the graduations. This dial has a graduated scale from 000 to 1000 and is read as 0 to 1000 kHz or .000 to 1.000 MHz.

Clarify: Provides ultra fine frequency adjustment (approximately 3 kHz range). This control is used primarily on ssb and cw signals for setting the pitch or sound accurately after the station has been roughly tuned in. It should be in the center position before any tuning is commenced.

Mode: Selects mode of reception. A-m (amplitude modulation), usb (upper single side band) and lsb (lower single side band). Cw (continuous wave) may be received on either usb or lsb position. The mode selector selects the proper detector (product detector for ssb and diode detector for a-m and i-f selectivity filter.

Band: Selects the proper range of received frequency.

Off-Volume: Turns radio on and off and adjusts audio output level.

Phone Jack: For ear phone reception or external speaker (8 ohms). Insertion of jack disconnects internal speaker.

Pilot Lamp Switch: On ac operation the pilot lamps are always lighted. The pilot lamps are normally extinguished on battery operation to conserve battery life. Pushing this momentary action switch turns on the pilot lamps.

Built-in Telescoping Antenna: The SSR-1 has such sensitivity that it operates near maximum practical limits. For optimum results, the receiver should be connected to an external antenna.

BACK PANEL CONTROLS

Record, External Battery, Mute Jack, Antenna Terminal Strip, Antenna Attenuator, Fuse.

Available from selected retailers or the Australian distributors:

ELMEASCO
Instruments Pty. Ltd.

P.O. Box 30 Concord, N.S.W. 2137
736-2888
Melbourne: 233-4044; Adelaide: 42-6666
Brisbane: 36-5061
Perth: 25-3144.

THE 27MHz SCENE

JIL 606CB REALLY PACKS IT IN

The JIL 606CB would appear to be a highly practical answer to those who want to have everything in their car, but who lack the space to stow it. In one compact unit, it combines a full 23-channel AM transceiver, an AM and FM/stereo broadcast receiver and a cassette player.

Housed in a metal case measuring essentially 188mm wide x 55mm high x 185mm deep, it is not all that much different in size from earlier, conventional AM broadcast receivers. And, while we have no way of knowing exactly which model cars will or will not accommodate it in-dash, it is packaged with bits and pieces of dash-mounting hardware and the implication is that it is compatible with the majority of family saloons and other road vehicles.

If so installed, and used in association with a fully retractable CB type antenna, the installation would not be at all obvious to a potential thief, unless they took a close look at the car "radio". Or unless the CB-style hand microphone was left in view.

The various functions of the unit are controlled by push buttons which occupy the same positions relative to the dial scale as the push buttons on an AM radio. When depressed, one such button switches the unit to CB mode, the required channel being selected by an inscribed knob mounted behind, and concentric with, the normal AM/FM tuning knob. Adjacent to it is another small knob which controls the CB receiver squelch.

As with most transceivers, the JIL 606CB is designed to work with a nominal 50-ohm resonant antenna system and a short connecting lead protrudes from the rear carrying the female SO-239 connector. Other specifications are:

CB RECEIVER: Sensitivity 1uV for 10dB S/N ratio; selectivity 5kHz at 6dB down; adjacent channel rejection more than 45dB; audio passband between 6dB points 400-2000Hz; AGC figure of merit more than 80dB.

CB TRANSMITTER: RF output 3.5W; modulation capability better than 80%; spurious suppression more than 50dB; frequency tolerance .005%; usable ambient temperature −30C to +50C.

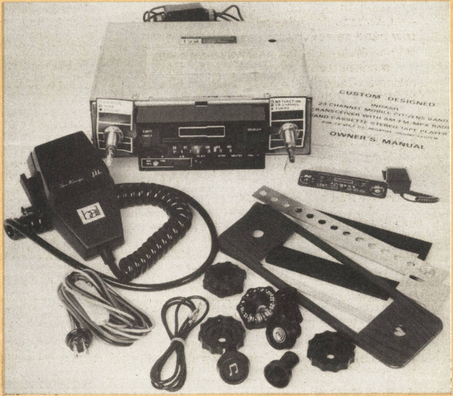
Tested on air in a typical suburban location, the CB section behaved in much the same manner as any other modern CB-type AM transceiver. In fact, its RF power output with 13V input was measured at 4W on all channels and therefore on the high side of average and above its own rating. Signal and modulation reports also pointed to a good RF performance.

When receiving on 27MHz, the double-change ceramic-filtered receiver gave a good account of itself, with ample sensitivity to cope with anything that was discernible above the natural ambient noise on this band. The receiver does not have an in-built speaker, being intended to work into the same stereo pair which serves the AM, FM and cassette play functions. Used with such speakers, the noises and voices on the 27MHz band tend to sound rather more "bassy" than one has become used to, heard over the usual, tiny in-built loudspeaker.

The JIL 606CB carries no metering to indicate supply voltage, signal strength or modulation depth. Operating a press-to-talk lever on the side of the CB-style microphone simply cuts off the receiver and changes a LED indicator from green to red, indicating transmit mode.

The designers have provided one facility, however, which is certainly unique. When the unit is being used in another mode—AM, FM or cassette—a "standby" push button will bring the CB receiver into simultaneous operation, but held mute by discrete adjustment of the squelch control. If a strong signal should come up on the CB channel selected, it will activate the CB receiver and mute the other function automatically. One may therefore listen to a radio or cassette program but be alerted instantly if something significant happens on the CB band being monitored.

And what of the other modes? Both AM and FM tuner sections operate from the one antenna—normally an ordinary car telescopic type. The AM tuner is conventional, with RF stage, frequency changer, IF amplifier and detector. It covers the full broadcast



In a bare metal case, and with an array of knobs and hardware, the presentation of the JIL 606CB is quite different from other CB units. The reason is simple: It is intended to mount in the normal radio space and, in fact, provides radio and cassette facilities as well.

THE 27MHz SCENE

band (530 to 1610kHz). The FM section likewise covers the full band from 88-108MHz, with in-built stereo decoding and a mono stereo switch to help cope with FM fringe conditions.

We did not perform any instrument tests on the receiver functions but their behaviour on the bench with a short length of aerial connected gave the impression of ample sensitivity and effective decoding of FM/stereo signals.

One practical point should perhaps be mentioned, however. While the dial scale lights up automatically for the radio mode, it is necessarily very small and the tuning mechanism is rather stiff and somewhat "springy". This is fairly obviously the result of the triple concentric shaft arrangements and the internal mechanics. With no pre-set tuning buttons to assist, a driver will therefore have to tune the radio by feel and sound, rather than by touch and sight.

The cassette play function is invoked by pushing the cassette endways into the slot. It disappears into the entrails of the equipment and the right things happen automatically. An indicator glows orange to indicate normal play and red to show that the tape has come to the end of its travel. It is a play-only facility, with no provision to record or to interconnect with the CB function.

But it certainly gives a good account of itself with a quality pre-recorded tape and the claimed frequency response of 50-10,000Hz, with 5+5W of power output should load up most sensitive automotive loudspeaker systems.

We were curious to look inside a unit which combined so many functions in the one compact case—considering that it had to contain a complete cassette play mechanism, two complete radio tuners, a transceiver with enough crystals to control 23 transmit and 23 receive channels, plus ICs, transistors and diodes, and hundreds of other bits and pieces.

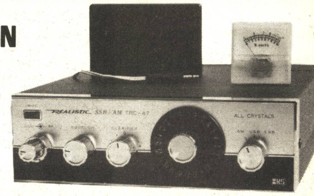
Sufficient to say that there isn't much waste space between the lids, although everything looks to have been planned solidly into position.

And, as we said, it certainly works and works well.

Australian agents for the JIL 606CB unit are Bail Electronics Services of 60 Shannon St, Box Hill, North Melbourne 3129; tel (03) 89 2213. They indicate that the unit is normally supplied complete with microphone, sundry connecting cables and items of mounting hardware, and an owner's manual. A service manual has been published but is not normally supplied.

Loudspeakers are also an extra but any 4-8 ohm car radio speakers can be used.

ADDING AN S-METER TO THE TRC-47



The Realistic TRC-47 is a very popular and efficient transceiver, but it has one limitation when used in a base station situation: it lacks an in-built S-meter. Fortunately, the provision of an external S-meter is a relatively straightforward operation.

There is a special problem with the TRC-47 in that is uses two quite distinct IF amplifier strips, each with its own selectivity characteristic: a 455kHz strip for AM and another centred on about 11MHz for SSB.

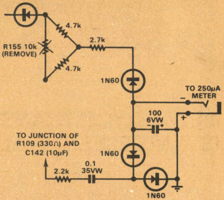
Prompted partly by the provisions in other Realistic models, technicians at Tandy's Rydalmere (NSW) Service Centre came up with a circuit arrangement which neatly solves both problems, using readily available components: the reading is meaningful and it is available for both AM and SSB.

For AM, two series-connected 4.7k resistors replace the existing 10k diode load. From the junction, a 2.7k resistor feeds the negative-going audio signal through a diode to an electrolytic capacitor where the signal is smoothed to a DC component, applied across a 250uA meter movement.

For SSB, a 2.2k resistor bleeds off some of the signal at the input of the LM307 IC and feeds it to a diode through a 0.1mfd capacitor. The rectified voltage so obtained is fed through a series diode to the same meter circuit as for the AM system.

Experience with a number of TRC-47s has shown that, with the constants as indicated, S-9 corresponds very closely to an AM input signal of 100uV, which is a fairly standard figure to aim for. On SSB, the meter reading varies with modulation, of course, but the amount relates logically to the same signal in AM mode.

In adding the S-meter circuit, it is desirable to group the tap-off components in each case very close to the relevant point on the circuit board. Two wires can then be run to a miniature earphone socket installed on the rear of the transceiver, the diodes and 100uF electrolytic being fitted at this point. The meter can simply be fitted with a lead and matching plug.



'S' METER

The circuit was arranged as shown to mate with a particular S-meter which Tandy carry as a spare part. It can be obtained via the Spare Parts Dept. at Rydalmere for $3.55. (Catalog number 20-152. RS part number M-0233). The meter face is marked S Units, with two scales, a linear 0-10 scale on the bottom and a normal S point scale at the top.

Looking around for a case in which to mount the meter, we came across the one pictured on top of the transceiver. From Dick Smith Electronics, catalog number H-2755, price $1.40.

While the two items lend themselves nicely to the job, it would be possible to use any other available meter with a sensitivity equal to or better than 250uA. In the latter case it could either be shunted back to 250uA or the series resistors increased proportionately to retain the same response to signal input.

FOOTNOTE: One point should be made which applies to modifications made to any commercial equipment. Officially, interference with the internal circuitry can void distributor's obligations, particularly during the warranty period. The distributor may not insist on this waiver if a fault has no connection with the modification. But be cautious.

THE 27MHz SCENE

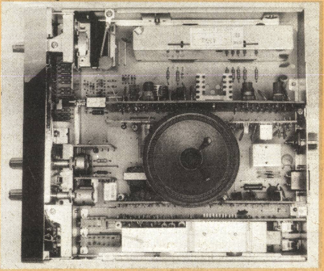
NEW ROYCE TRANSCEIVER IS "WIRELESS"—ALMOST!

Unitrex of Australia Pty Ltd have announced that they will be marketing 27MHz transceivers in Australia, manufactured by the Royce Electronics Corporation of Japan.

According to Unitrex Managing Director, Daniel Presser, the Royce product line is distinguished by very high quality standards and by constructional methods which minimise the use of wired internal connections.

The unit pictured above the Royce model 1-662, is certainly very attractively finished. A bold, chrome-plated strip encircles the fascia panel, which is itself finished partly in black grained vinyl and partly in simulated woodgrain. It gives the impression of being able to harmonise naturally with the finish in most modern cars.

The 1-662 is a 23-channel AM only transceiver, which employs two crystals in what Royce refer to as their, "Gyro-Lock" circuit, to provide precise crystal control of all transmit and receive channels. A fine tuning knob provides for any necessary adjustment to accommodate to off-frequency transceivers, giving an increment of plus and minus 1.5kHz.



Both externally (above) and internally (right) the Royce 1-662 is a very clean looking design. A volume control on the side of the microphone is a handy feature.

The channel selected is displayed by a LED readout system behind a darkened window, with a push-button just above to control the brightness of the display. Another small indicator nearby glows red to indicate that the unit is in the transmit mode.

Other facilities on the front panel include an RF gain control, an audio volume control with off-on switch, a continuously adjustable squelch, automatic noise limiter off-on, and a switch to select the public address function. There is also a vertical display S-meter, which doubles in transmit mode as an RF power meter. On the rear panel is the usual antenna connector, a DC power input socket and a pair on pin jacks for connection to the external public address loudspeaker.

An interesting feature of the 1-662 is the provision of a supplementary volume control on the case of the microphone. By pre-setting the main volume control, the knob on the microphone can be used to cope with short-term variations in vehicle and road noise.

Looking inside the transceiver, one is immediately aware of the sparsity of wiring and the degree to which the design relies on the use of a "mother" board to inter-relate the smaller PCB's and modules. It makes for a very clean presentation.

Like most other 27MHz transceivers, the 1-662 assumes the use of a properly matched 50-ohm resonant antenna, fed through 50-ohm cable. The power output meter on the front panel is marked for this condition, presumably on the basis that the rated 4 watts RF output will deflect the meter along the black portion, representing the initial two-thirds of the pointer travel.

The remaining one-third of the scale is in red, indicating an abnormal condition.

Electrical specifications for the 1-662 credit the receiver with a sensitivity of 0.5uV for 10dB S/N ratio, an adjacent channel rejection of more than 60dB, and a selectivity of 5kHz at 6dB down. Audio bandwidth is 400-2000Hz for 6dB down, and power output 4W into 8 ohms.

Transmitter power is 4W, frequency tolerance ± 0.005%, modulation capability 100%, and spurious suppression 50dB.

Unfortunately, our report on the Royce 1-662 has to remain incomplete for the time being, because the advance sample that was available for inspection had suffered damage or from unauthorised "fiddling", so that the transmitter power and modulation were both obviously well below normal. However, the receiver gave a very good account of itself and we were prepared to accept this as an indication of the potential good performance of the unit as a whole.

For further information on Royce transceivers: Unitrex of Australia Pty Ltd, 105 Queen St, Melbourne 3000. Tel. (03) 67 9121.

Get the most out of your CB rig with this

Preamplifier for 27MHz

Here is an excellent "home brew" version of a gadget which has proved particularly popular overseas with 27MHz—and 28MHz—operators. Operating from 12 volts and connecting directly in series with the coaxial antenna cable, it can boost weak incoming signals or attenuate excessively strong signals at the turn of a knob. Press the "transmit" button and it switches automatically to a straight-through connection.

by IAN POGSON

With large numbers of 27MHz transceivers being used at the present time, many of them can benefit to a greater or lesser extent from the addition of just such a preamplifier. The same is true, on a smaller scale, of 28MHz transceivers—and receivers.

The units likely to benefit most are the older or lower priced models where front end design, signal-to-noise ratio and overload characteristics are not what might be termed "state of the art". By adding a preamplifier with gain and a good signal-to-noise ratio, the effect can be quite dramatic; signals, down in the noise, suddenly become loud and clear. Alternatively, with the attenuator facility built into the preamplifier, strong signals which might otherwise cause overload problems, can be substantially reduced in level.

More expensive modern units, many of which have excellent signal-to-noise ratio and overload characteristics, stand to benefit less from the use of a preamplifier. Even so, some operators with these higher quality units declare that they have benefited by adding a commercial preamplifier, particularly where they are operating from a bad or remote location.

Mobile operators, of course, have to cope with a variety of problems: compromise antenna systems, acoustic and electrical noise in and around the vehicle, locations which vary from superb to terrible and "blotto" signals from a car which ranges alongside. Some transceivers are equal to the challenge; many are not.

Last but not least, there are many amateur band receivers and transceivers still in use, with valve or early transistor front ends. Performance usually droops markedly towards 30MHz and the addition of an external high-gain low-noise front end can likewise work wonders.

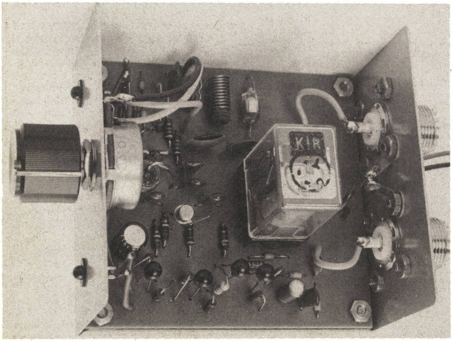
Commercially made preamplifiers are available on the market, which are well designed and built units. (See page 32, April issue.) In spite of quite a high price tag, we understand that sales are brisk. However, if you would like to make one yourself, either to save money, or for the satisfaction of so doing, our new preamplifier appears to match up well with the commercial units.

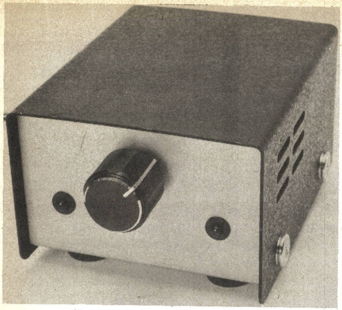
To be of any real value, a preamplifier must have a useful amount of gain, while the signal-to-noise ratio must also be as good as may be achieved with reasonable cost and complexity. In addition, the signal handling ability should be such that it will cope with strong signals without overload, and there are times, as already pointed out, when it is desirable to invoke attenuation rather than gain.

For convenience, a supplementary preamplifier should connect directly in series with the antenna coaxial feeder, processing all incoming signals but switching out of circuit automatically when the transmit button is pressed.

In the commercial units and our home-brew version, the changeover function relies on a high level RF sensing circuit coupled to a DC amplifier, which operates a relay. Two sets of contacts switch the preamplifier out of circuit during transmit, while an extra transistor simultaneously removes the supply voltage from the preamplifier.

With an AM transmitter, the relay remains energised while ever the press-


A single PC board accommodates most of the components, including the relay. The antenna socket is at top right, with the transmitter socket below.



Our prototype 27MHz preamplifier has about 25dB of gain at one extremity of the control pot, and about 40dB of attenuation at the other.

PARTS LIST

1 Metal box, 83mm wide x 56mm high x 102mm deep
1 Printed board, 87mm x 79mm code 77pre5
1 Relay, 2 sets changeover contacts 185 ohms 12V
1 PCB socket for relay
1 470uH RF choke
4 Transistors, BC208, BC548, etc
1 Transistor, BF115, BF494, etc
1 Transistor, MPF131
5 Diodes, 1N4148, etc
1 Diode, EM401, etc
2 LEDs, type NSL5023 or similar, with bezel
1 Slug, Neosid grade 900 to fit 7.6mm formers
2 UHF coax sockets, type SO-239A
1 Knob

RESISTORS (½W unless stated otherwise)

1 100 ohms
1 470 ohms
1 560 ohms
2 680 ohms
1 1.2k
1 1.8k
1 4.7k
1 6.8k
1 10k
1 12k
2 22k
2 47k
1 220k
1 270k
1 10k log pot
1 50k subminiature trimpot

CAPACITORS

1 10pF NPO ceramic
1 47pF NPO ceramic
1 100pF polystyrene or NPO ceramic
1 220pF polystyrene
2 .001uF 100V greencap
5 .01uF 100V greencap
1 3.3uF 50VW electrolytic
1 47uF 16VW electrolytic

MISCELLANEOUS

Hookup wire, solder, solder lugs, rubber grommet, screws, nuts
Note: Resistor wattage ratings and capacitor voltage ratings are those used on the prototype. Components with higher ratings may generally be used providing they are physically compatible. Components with lower ratings may also be used in some cases, providing the ratings are not exceeded.

to-talk button is held down, because the carrier is present, irrespective of modulation.

In SSB mode, however, RF energy falls substantially to zero during silent periods, so that the relay may tend to drop out during the breaks between words. To prevent the relay from "chattering", time constants in the actuate circuit must be arranged so that the relay will hold in for about 1 second, sufficient to bridge any small breaks between syllables. If the operator pauses for longer than a second, allowing the relay to drop out, it must close as rapidly as possible at his next word, to avoid clipping the first syllable.

The circuit as shown meets these requirements very well, being voted by one operator as the best "vox" he had heard.

The unit, as pictured, is assembled on a printed board and there are no complicated parts to contend with. In short, no trouble should be encountered in building the preamplifier and getting it going.

Looking first at the preamplifier section, input from the antenna is fed via one set of relay contacts into a capacitive divider which forms a tuned circuit with a variable inductor. Signals from the tuned circuit are then passed to the first gate of a dual gate MOSFET, which is used because of its ability to handle large signals before overload, together with the possibility of realising a good signal-to-noise ratio. These features require careful arrangement of the DC operating conditions, which accounts for the rather unusual biasing circuitry.

Gain is controlled by varying the bias on the second gate by means of a potentiometer, a preset potentiometer being used to set the range of control.

The drain of the MOSFET is untuned, with a 470uH RF choke serving as the load. Signals emerging at the drain are transformed to a low impedance via an emitter follower. From the emitter follower signals then pass through another set of relay contacts to a second UHF coaxial socket and so to the transceiver (or receiver).

In laying out the preamplifier considerable care was taken to minimise the risk of feedback and instability. A point of concern is that both input and output have to pass through adjacent relay contacts but no difficulties were evident, probably because both circuits are at low impedance—nominally 50 ohms.

Turning now to the sensing circuit, in the "receive" condition there is no effective drive to the first BC208 and it is not conducting. As result, there is forward bias on the second BC208; in this condition, it deprives the third BC208 of forward bias and it is cut off. Since the relay winding is in the collector of this transistor, and as no current is flowing, the relay will remain at rest, leaving the preamplifier in circuit.

The fourth BC208 derives its forward bias from the collector of the third transistor and, in the "receive" mode, the fourth transistor is conducting. Being connected as an emitter follower, it provides the supply voltage for the MPF131 MOSFET and the BF115 emitter follower.

As soon as the transmitter is switched on, high level RF appears at the 10pF capacitor. It is rectified by the two 1N4148s, charging the 3.3uF and 0.1uF capacitors in parallel. This provides a source of forward bias via the 22k resistor and turns on the first BC208. In so doing, the following three stages reverse their former condition, resulting in the relay being operated. Simultaneously, the supply voltage is cut off from the RF amplifier and emitter follower output.

The changeover takes place very rapidly, in a matter of milliseconds.

When the transmitter is again switched off, the voltage across the 3.3uF capacitor continues to discharge for a time through the 22k resistor into the base of the first BC208, which continues to conduct. After about one second, the capacitor is discharged to the point where the transistor no longer conducts and the preamplifier becomes operative again.

Two light emitting diodes (LEDs) are used as indicators. One is across the supply, in series with a 680 ohm resistor and indicates that the power supply is on. The other LED, in series with a 680 ohm resis-

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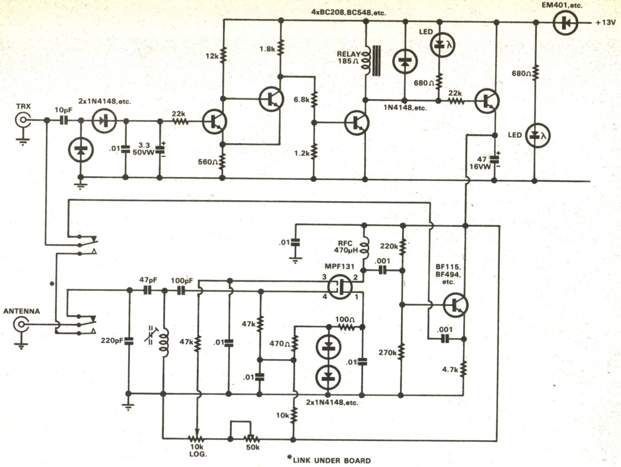


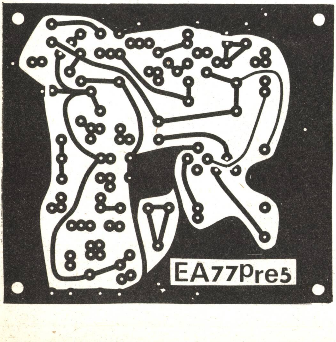
*LINK UNDER BOARD

27-28MHz PREAMPLIFIER

tor, is connected across the relay winding and glows under "transmit" conditions.

The 1N4148 diode across the relay winding is to protect the transistor from possible damage from spikes induced by the relay winding as the circuit is opened. The power diode at the input of the +13V supply is added as protection against the possibility of a reversal of supply voltage polarity.

All components specified are in normal supply at the time of writing. The box which we used is distributed primarily by Dick Smith Electronics but other components are routine items for most suppliers. If for any reason, you wish to use a different box, there is no reason why you should not do so, provided that the layout is not altered unduly. This applies particularly to the input and output leads and sockets.



Here is the PC pattern, reproduced actual size to allow tracing.

It was suggested by one of our staff that, in cases where it is desired to "broadband" the preamplifier for use on both 27 and 28MHz, the LC ratio of the input tuned circuit could be changed to advantage. It may be made broader by increasing the value of the inductance and reducing the effective value of capacitance across it. The inductance could be increased by adding an extra turn or two and by setting the slug almost right in. The effective capacitance would then have to be adjusted to give the required resonance. Note that the ratio between the two capacitors should be kept about the same as in the prototype.

Construction is fairly straightforward but the usual care should be taken not to overheat any components when soldering. Due to the fact that the board layout is rather compact, a little extra care may be needed. It is a good idea to fix the smaller components first, starting with the resistors, then diodes, capacitors, transistors, etc. Make sure that com-

TDK TEST TAPE (CASSETTE)

now available

Type No.	Application	Contents (Prerecorded)
AC-211	Recording Characteristics Alignment	Blank (Contain No Signal)
AC-311	Playback Level Calibration	333 Hz 0 dB Full Track Width
AC-312	Playback Level Calibration	1 kHz 0 dB Full Track Width
AC-313	Calibration for Dolby Playback Level	Dolby Calibration Tone 200 pWb/mm Full Track Width
AC-321	Head Azimuth Alignment	6.3 kHz—10 dB Full Track Width
AC-322	Head Azimuth Alignment	8 kHz—10 dB Full Track Width
AC-331	Frequency Characteristics Measurement	333 Hz 0dB, 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1 kHz, 2 kHz, 4 kHz, 6.3 kHz, 8 kHz, 10 kHz—20 dB Full Track Width
AC-333	Frequency Characteristics 4 Points Check	63 Hz, 333 Hz, 3 kHz, 6.3 kHz—10 dB Full Track Width
AC-351	Crosstalk Measurement & Head Location Adjustment	1 kHz 0 dB Track 1 only
AC-352	Crosstalk Measurement & Head Location Adjustment	1 kHz 0 dB Track 2 only

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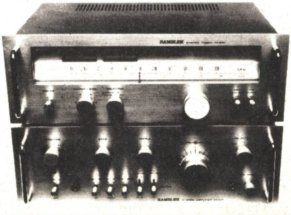

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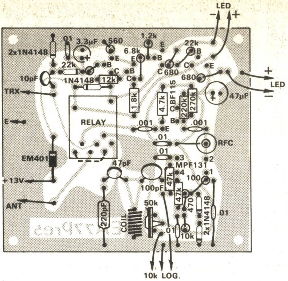


This component layout diagram shows the PC board as viewed from the component side. Take care to ensure correct orientation of polarity conscious components.

ponents requiring it are inserted with due regard to polarity.

The tuning coil consists of 11 turns of 22B&S enamel wire, wound directly on a Neosid grade 900 slug. The two ends should be bent so that, when bared and tinned, they will pass through the holes provided on the board. The slug should be left in the centre of the coil until the final adjustment stage.

Having fixed all components to the board, leads of sufficient length should be attached for the plus and minus supply, connections to the two coaxial sockets, including an earth lead, the two LEDs and the gain control. Note that a link of hookup wire must be added underneath the board, across the relay contacts as shown on the circuit.

The board assembly is now ready to be fitted into the box. Holes have to be driled to mount the board, together with holes for the gain control and LEDs on the front panel, and for the coaxial sockets and a grommet in the back panel.

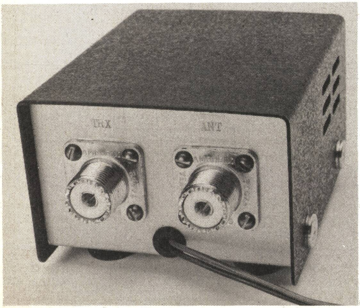
With all the holes ready, the board should be mounted first, using four ⅛in Whitworth RH screws, ½in long, with the screw heads underneath. Three nuts are used on each screw to stand the board off the bottom of the box by about 8mm. Power supply leads are brought out through a grommeted hole on the back panel, as mentioned earlier.

When fixing the two coaxial sockets on the back panel, a solder lug should be provided under each of the two top adjacent screws. The ends of the lugs are brought together and soldered and the earth lead from the board is terminated on these lugs. Leads are also run to the respective centre contacts of the two coaxial sockets.

It will depend upon the type of LEDs which you use as to how they are fixed to the front panel. With the type we used, we glued the main body of the plastic holder with Araldite to the back of the panel, dispensing with the "nut" as being rather too difficult to fit. The leads of the LED are bent at right angles, so as not to foul other components nearby, and connected to the board by the hookup wire leads already provided.

When fitting the gain control potentiometer to the front panel, it may be necessary to bend the RF choke out of the way.

At this stage construction is complete and it is only necessary to make a couple of adjustments before the unit is ready for use.



Rear view of the prototype. Make sure that connections to aerial and transceiver are correct, or damage could result.

Set the gain control to maximum (rotor nearest the 50k trimpot) and set the 50k trimpot rotor to mid position. Connect a short cable between "TRX" socket and the transceiver. Connect the aerial feedline to the socket marked "ANT". MAKE SURE THAT YOU HAVE THESE CONNECTIONS CORRECT, OTHERWISE DAMAGE COULD RESULT. Connect the power supply leads to a source of 12 to 13.5V; current will range from about 25 to 90mA, depending on operating mode.

Switch on (the power supply LED should glow) and tune to an AM signal in about the centre of the band, say between channels 10 and 13. With an insulated aligning tool, adjust the slug so that it moves towards the 100pF capacitor, for maximum response on the receiver's S-meter. In our prototype the slug tuned from 25MHz full in to 30MHz well out.

Next, advance and retard the gain control and determine whether there is a "flat" part at the last of its travel towards maximum. If there is, increase the amount of resistance of the 50k trimpot in circuit until gain increases continually as the control is turned up fully. If no flat is evident, the 50k trimpot should have its resistance reduced until a flat portion is evident and the trimpot should be set back until the flat disappears.

In our prototype, we were able to confirm about 25dB of gain with the control fully clockwise and about 40dB of attenuation at the other extreme. By using a logarithmic potentiometer, the gain was spread conveniently over the arc of rotation, with unity gain occurring at about "2 o'clock".

The preamplifier is now complete and the cover of the box may now be fitted and the unit is ready for use. ⊛

Digital quartz clock module runs from 12V

Superficially, you might think that the new National Semiconductor MA1003 digital clock module is only suitable for cars and boats, but this is only the tip of the iceberg. In fact it is a complete quartz-crystal derived digital clock, operating from a nominal 12V DC supply, with all sorts of fixed, mobile and portable applications.

by JAMIESON ROWE

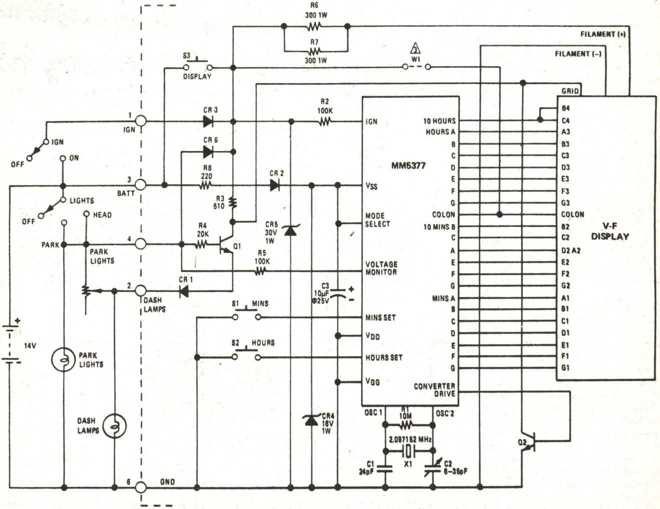
One of the range of digital clock modules which was recently released by NS Electronics is the MA1003, described in the NS literature as a "12VDC automotive/instrument clock module". Like the other modules, including the MA1002B which we used in a project in the December 1976 issue, it comes as a small assembly based on a compact PC board. In this case the PCB measures a mere 77 x 45mm.

As with the other modules in the range, the actual clock chip is bonded directly onto the rear of the PC board, rather than in a conventional IC package. The chip is protected by a blob of epoxy cement, to protect it from moisture and physical damage.

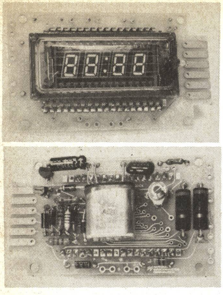
Unlike the other modules, the MA1003 does not use LED display chips bonded to the PC board. Instead it uses a 4-digit vacuum fluorescent display, in a flat "36-pin DIL" glass package. This gives a bright green readout, with digits 0.3 inches high.

But the main difference between the MA1003 module and the others in the range is that it is designed to operate from a nominal 12V DC supply. It has an inbuilt quartz crystal oscillator running at 2.097152MHz, together with the full divider chain required to produce the necessary minutes and hours pulses for the clock counter. All of the oscillator, divider and clock circuitry is contained in a single MOS LSI integrated circuit, the MM5377.

In other words, the MA1003 module is really a complete quartz-derived digital



Here is the circuit for the National Semiconductor MA1003 module, showing also how it is connected up in a typical car or truck. As it is basically a complete quartz-derived 12V digital clock, it has many other applications as well.



Front and rear views of the MA1003 module. The display is a 4-digit vacuum fluorescent type; the clock chip itself is bonded to the PCB beneath the crystal.

clock, capable of operating from any 12V DC source. It is thus suitable not just for cars, trucks and boats, but for many other applications—wherever an accurate clock is required, independent of the power mains.

Even operation from dry batteries is quite practical, because the timekeeping and display readout sections of the module are independent.

As you can see from the circuit we have reproduced from the NS literature, the main 12V supply connections to the module are via edge connector pins 3 (+) and 6 (–). These provide power for the timekeeping circuits, which draw very low current: typically 3mA, and a maximum of 5mA.

Providing these connections are made and the battery voltage does not fall below 5V, the timekeeping circuits will function and keep accurate time. To activate the display as well, it is necessary to either connect edge connector pin 1 to the +12V line, or alternatively close the "display switch" connections provided at the bottom of the module.

For use as a portable battery-operated clock it would be desirable to fit a pushbutton to control the display in one of these two ways, as the current drain rises to about 100mA when the display is activated. The pushbutton would thus allow the high-current display to be activated only when actually needed.

Time setting is done by two external pushbuttons, which connect to the S1 and S2 pads at the left-hand end of the module. Edge connectors 2 and 4 are provided to allow the clock display to be dimmed when a car's parking lights are turned on, and when the dash lamps are dimmed.

The MA1003 module is currently selling for around $35 from many retailers, making it very good value for money.

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Easy to build circuits using TGS Sensor:

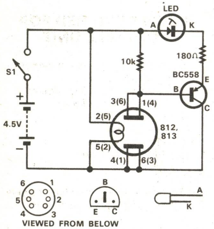
Gas Analyser for Marine and Automotive use

Two new models of the Figaro TGS gas sensor are now available in Australia, so we felt it was appropriate to update our previous designs for gas detectors. In this article we present a design for a small, portable detector, and a design for a gas analyser suitable for automotive or marine use.

by DAVID EDWARDS

The Figaro TGS gas sensor is a gas sensitive semiconductor, which was developed by Mr N. Taguchi of Japan, and is at present being marketed in Australia by Digitron Engineering. More than ten million of these sensors are at present in use, with the main application being in gas leak alarm systems and fire (smoke) alarms.

TGS is a sintered n-type semiconductor bulk device composed mainly of SnO_2 (tin dioxide), whose conductivity increases in the presence of combustible gases such as hydrogen, carbon monoxide, methane, ethane, propane, or organic solvent vapours belonging to the alcohol, ketone, ester and benzol families. The ratio of conductivity in air to conductivity in low concentrations of suitable gases can be as high as twenty times.



PORTABLE GAS DETECTOR

FIG. 1 3/MS/—

This simple circuit gives a go/no go indication of whether gas is present or not.

Embedded in the semiconductor chip are two sensing electrodes and a heating element. The heater is required to enable gases and vapours to be both adsorbed and de-adsorbed rapidly, and to minimise the effect of ambient temperature variations on the conductivity of the sensor. The heater element is rated at 5V, and draws approximately 125mA.

The electrodes are used to measure the conductivity of the chip. Each electrode is supplied with two pins, which are normally connected together. The resistance between the electrodes is normally around 40k when the sensor is in clean air, falling to much lower values in even very small concentrations of the gases mentioned previously.

Two types of detector are currently available, with type numbers 812 and 813. These are electrically identical, but have differing responses to different gases. Type 812 has a high sensitivity to carbon monoxide, and is recommended for use in smoke or exhaust gas detectors. Type 813 has a high sensitivity to methane, and is recommended for use in natural gas detectors.

Fig. 1 shows the circuit of a simple yes/no gas detector. Three 1.5V "D" cells are used as a power supply, with S1 acting as an on/off switch. The heater is energised directly from the battery, while the electrodes are in series with a 10k resistor. The voltage across this resistor is monitored by a PNP transistor.

When the sensor is in clean air, the resistance between the electrodes is about 40k, so that only about 0.9V is dropped across the 10k resistor. This is insufficient to turn on the transistor, because of the extra 1.6V required to forward bias the light emitting diode (LED) in series with the emitter.

When the sensor comes into contact with contaminated air, its resistance starts to fall. This increases the voltage dropped across the 10k resistor. When the sensor resistance falls to about 10k or less, the transistor starts to turn on, allowing current to pass through the LED, which then emits. The 180 ohm resistor limits the current through the LED to a safe value.

The prototype of this simple gas detector was mounted in a plastic zippy box, measuring 130 x 68 x 41mm. The sensor unit was mounted in a standard 7 pin valve socket fitted to one end of the case. The LED and power switch were fitted to the aluminium lid of the box, with the batteries taking up most of the interior space.

We found that if the internal strengthening rib of the box was removed using a chisel or similar tool, the batteries could be fitted to the box as shown in the photographs. The slight amount of "end play" was taken up by "L" shaped pieces of galvanised iron (or brass, or tinplate), which also served as connectors to the battery terminals.

These can be fixed in position with a small amount of epoxy glue, and the connections to them made by soldering. The batteries are fitted in the end of the box furthest from the sensor socket, to allow sufficient room for both the socket and the LED. The on/off switch is placed so that it protrudes into the space between the two batteries nearest the end of the case.

The transistor and associated resistors

are mounted on the rear of the sensor socket, keeping all leads as short as possible, and remembering that clearance has to be provided for the LED terminations. The sensor itself is non-polarised, and can be inserted into the socket two ways.

When the circuit is first turned on the LED will illuminate after a short delay. This is because the sensor absorbs contaminating gases from the air while not in use, and these must be driven off by the heater before the clean air resistance is obtained. When this happens, the LED will go out, and the detector is then ready for use.

To test the sensor, simply place it near a suitable gas source, such as an unlit gas jet, an open can of petrol, or even an alcoholic breath. The LED should illuminate fairly rapidly, and go out again when the source of gas is removed.

Turning now to Fig. 2, we can examine the second circuit presented in this article. This circuit uses a bridge arrangement, with a 0-1mA meter as an indicator. It can be used as either an automotive exhaust gas analyser, or as a bilge gas detector for boats. It is intended to be powered from a 12V battery.

The battery voltage is reduced to a nominal 5V by a zener diode and series dropping resistor. This eliminates the effects of variations in battery voltage. For automotive use, where the unit will be connected directly across the battery using crocodile clips, a series diode is provided to prevent damage if the polarities are accidentally reversed. Sensor type 812 would normally be used in this application.

For marine use, where the unit will normally be connected to the battery permanently, the protective diode is not required, and is replaced by an on/off switch, which would normally be mounted adjacent to the indicating meter. Sensor type 813 would normally be used in this application.

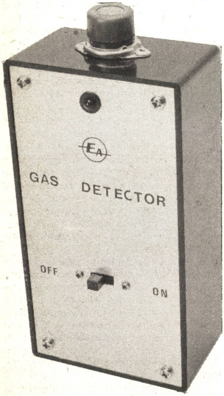
As before, the sensor electrodes are wired in series with a 10k resistor, forming one side of a bridge. The other side of the bridge is formed from a 10k trimpot. The meter is connected in series with a 4.7k resistor across the bridge, with the polarity as shown.

After the sensor has been energised for some time in a clean air situation, the trimpot is used to zero the meter. If the sensor is then placed in a suitable gas mixture, a deflection corresponding to the strength and type of gas or gases present will be obtained.

We found that with our prototype the meter always returned to zero when the sensor was returned to a clean air situation, and thus the trimpot did not require re-adjustment.

The physical construction of the unit will depend on the intended use. For a marine application, the meter can be mounted in some convenient spot, with the associated circuit components mounted on a small piece of tagstrip fixed to the meter terminals. If the meter is mounted in a panel, the on/off switch can be mounted next to it. The sensor unit can then be mounted in the bilge of the craft, and connected to the circuit using a three core cable. Light duty mains flex is ideal for this.

We assembled our prototype of this circuit in a form suitable for use as an auto engine analyser. The meter was mounted on the lid of a zippy box, measuring 150 x 90 x 50mm. We used a standard 10k pot as the zero adjustment, with the shaft cut off close to the bush,



This is the finished portable detector. The front panel lettering was done with pressure sensitive lettering, protected with lacquer.

PARTS LIST

PARTS REQUIRED FOR MARINE AND AUTOMOTIVE UNITS

1 type 812 or 813 TGS gas detector
1 seven pin valve socket
1 0-1mA moving coil meter
1 5.1V 1W zener diode
1 10k resistor
1 4.7k resistor
1 33 ohm 5W resistor
1 10k trimpot

EXTRA PARTS REQUIRED FOR MARINE USE
1 SPST switch
1 case, as required
1 length of three core cable (light duty mains flex) solder, hookup wire, machine screws and nuts

EXTRA PARTS REQUIRED FOR AUTOMOTIVE USE
1 silicon diode, EM401 or similar
1 case, 150 x 90 x 50mm
2 alligator clips
1 metre of two core cable
6 metres of three core flex cable (mains light duty mains flex)
1 1 litre tin with screw cap
3 cord clamps
1 8 lug tagstrip with 1 mounting foot
1 capacitor clamp (see text)

solder, hookup wire, machine screws and nuts

NOTE: Resistor wattage ratings and capacitor voltage ratings are those used for our prototype. Components with high ratings may generally be used provided they are physically compatible.

PARTS REQUIRED FOR PORTABLE UNIT

1 type 812 or 813 TGS gas detector
1 seven pin valve socket
1 PNP transistor, BC558 or similar
1 LED (light emitting diode)
1 10k resistor
1 180 ohm resistor
1 SPST slide switch
1 case, 130 x 68 x 41mm
3 "D" cells

Solder, hookup wire, machine screws and nuts, scrap galvanised iron.

NOTE: Resistor wattage ratings and capacitor voltage ratings are those used for our prototype. Components with high ratings may generally be used provided they are physically compatible.

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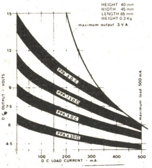

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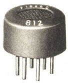

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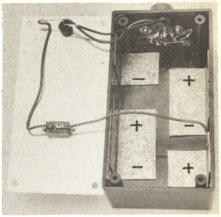


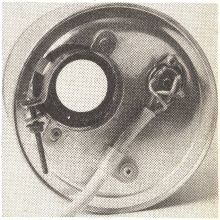
This photograph shows how the battery clips were positioned in the box.

and a slot cut in it for screwdriver operation. The remaining components were mounted on a small piece of tag strip, held in place by one of the meter mounting screws.

One metre of two core flex, fitted with large alligator clips was used to make connections to the car battery, and a six metre length of light duty three core mains flex to make the connections to the sensor unit. This length can be varied to suit particular cars.

The probe assembly used to couple the exhaust gas into the sensor was made from a discarded 1 litre paint stripper tin, and a capacitor mounting clamp. This clamp is chosen to be slightly larger in diameter than the exhaust pipe. A circular hole of the same diameter as the clamp is cut in the bottom of the tin, and the clamp positioned over it with the aid of pop rivets or machine screws and nuts.

This enables the exhaust pipe to be inserted partly into the tin, and clamped in position. The lid is left off the tin, allowing the gases to escape. The sensor unit



In the photograph above, you can see how the capacitor clamp is mounted on the end of the tin, along with the socket for the TGS sensor.

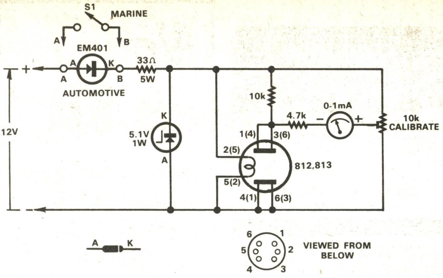
is mounted in a 7 pin valve socket, fixed upside down on the base of the tin, (near the capacitor clamp), so that the sensor is mounted inside the tin. Strain relief for the cable to the meter unit is provided by a mains cord clamp. Refer to the photographs for further details.

Remember that any traces of paint/stripper or similar substances which could give off gases should be removed, as these gases may give erroneous results.

As an alternative to this style of probe assembly, a unit similar to that used by Heathkit in their exhaust gas analyser could be constructed. Readers interested in obtaining further details should consult the September 1976 issue.

As with the hand held detector, when the unit is first turned on, a deflection will be obtained on the meter. When the reading stabilises, adjust the 10k pot to null the bridge. This must be done in clean air.

For the marine application, this would be best done before installing the sensor in the boat, as otherwise any gases present initially would be "nulled out". In use, the unit should be switched on about 10 minutes before starting the engine, and the meter reading monitored. It should return to zero before an attempt is made to start the motor.



EA GAS DETECTOR

FIG. 2

There is no risk of an explosion caused by the sensor's heater igniting any gases present when it is first switched on, as the sensor is covered with a double layer of 100-mesh gauze, which is proof against explosions.

Do not rely absolutely on the meter indication, however. The bilge should always be kept well ventilated, and checked by other means if the meter reading is at all doubtful. Probably the simplest backup check is to use your nose, which can be very sensitive indeed.

The automotive unit can be used to check and adjust the carburettor settings. The engine must be fully warmed up, however, as otherwise misleading results may be obtained. Only comparative results can be obtained, because of the difficulty in calibrating the meter.

One scheme for obtaining a partial calibration is to have the car tuned professionally, and then to note the reading obtained on the meter. Subsequently, the car can be retuned so that the same reading is obtained.

If when you are adjusting the mixture, a higher reading than the original reading is obtained, then the mixture will be too rich, and should be made leaner. Conversely, a low reading indicates a lean mixture which will require to be made richer.

Finally, remember that to obtain meaningful results, the timing of the ignition must be correct, and that the valves and associated mechanical parts must be in good working order.

Further details of the price and availability of the TGS sensor units can be obtained from the Digitron advertisment on page 98 of the April 1977 issue.

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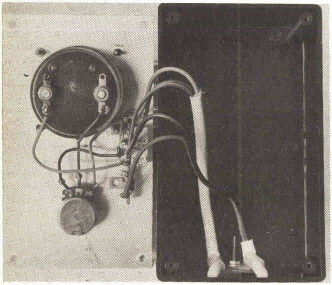
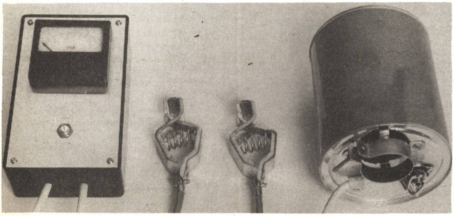
At the top of the page is the circuit diagram for the automotive unit, while at left is a photograph showing how the components are mounted.



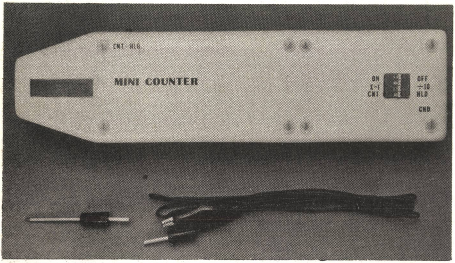
Shown below is the completed engine gas analyser. The crocodile clips connect to the battery terminals.

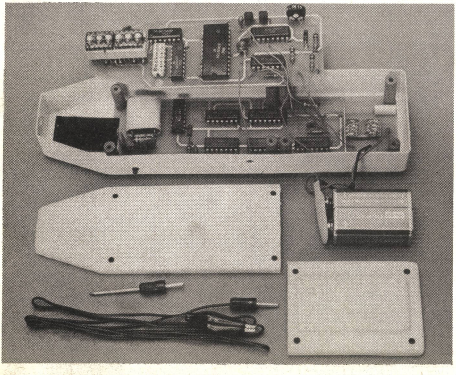


Mini frequency counter comes as a kit

Those who have need of a portable battery-powered frequency counter could well consider the Mini Counter described here. The design employs twelve integrated circuits plus two display chips, features a five digit readout, and can measure up to 1MHz. It is available only as a build-it-yourself kit, and is easy to build and get going.

by BRIAN BALDIE
President, Syntec Corporation, 87 Hughes Ave, Chelsea, Vic 3196.





Ever since the introduction of CMOS circuits, test instruments have been coming down in size. Making the instrument portable will produce an excellent field service tool for jobs that separate you from the workshop. Ideally, the best solution to all field service and design problems would be a set of instruments small enough to fit in a brief case.

This really is not an impossible task. For example, there are many logic probes and digital volt meters available in very small cases. Now, for the first time, a frequency counter has been reduced to the size of a hand-held probe.

Called the Mini Counter, the new instrument comes as a kit of parts. When assembled, it measures just 200 x 50 x 25mm (L x W x H) and requires no coax cables. Fig. 1 shows an assembled Mini Counter with an assortment of removable tips. Note that the unit in the photographs is a prototype model and does not exhibit through-hole-plated or silk screened boards; nor is the case a production punched housing as on later models.

The Mini Counter exhibits many of the features found on expensive counters, such as sample and hold, auto cycle, totalise, high stability timebase, long battery life, input protection, and a 1MHz frequency range. The counter's input impedance is greater than one megohm, and input sensitivity less than 100mV for frequencies up to 100kHz. Sensitivity is reduced to 500mV at 1MHz.

A typical 9V battery will power the counter in excess of 15 hours. If a mercury battery is used, battery life will increase to approximately 35 hours.

Fig. 2 shows the circuit diagram of the new frequency counter. The circuit can best be separated into three parts: timebase and control, input stage, and counter.

The Mini Counter operates from a 2097.152kHz crystal, which can be fine trimmed by either increasing or decreasing capacitor C1. The crystal oscillator is divided down to 1Hz by a 21 stage ripple counter IC1. The positive edge of the 1Hz signal triggers IC3a, while the negative edge triggers the decade counter IC5a.

IC5a provides the second auto cycle feature, shown as "CNT" on the selector switch. If switch 2a is closed the RS flip flop formed by gates IC2a and IC2b will set every three seconds, starting a new cycle. The cycle can also be started by momentarily closing the "CNT-HLD" switch S1.

Flip flop IC3a will transfer a high to the Q output on the positive edge of the next clock pulse. This transfer will start the one second timing sequence and activate the timing flip flop IC3b. Setting IC3a will also clear the main counter and three second timer to zero by gating IC2c high until the first clock pulse from the input circuit triggers IC3b.

Clocking IC3b enables the input stage to gate the signal to the counter. One second later, IC3b is gated low again by flip flop IC3a. The next input pulse therefore causes IC3b to be reset, closing gate 6b synchronously with the input pulse, and indicating the result on the display readout. (Editorial note: this synchronised gating system is presumably used to obviate "bobble".)

The input circuit conditions low or high level signals into square waves. Waveforms as slow as one cycle can be measured with good accuracy.

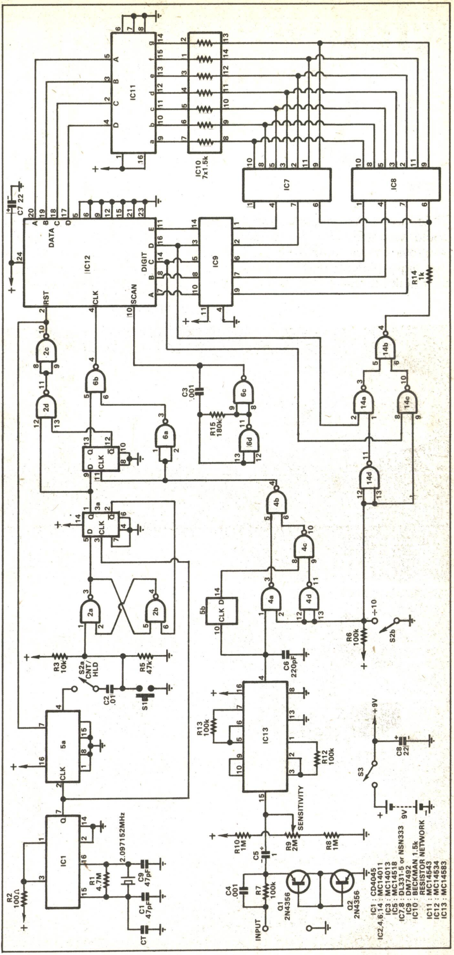
The input must be protected against overload conditions in order to protect the CMOS circuits. Transistors Q1 and Q2 clip all signals to a safe level. Voltages up to 200V p-p have been tested. Capacitor C5 removes the DC element from incoming signals and potentiometer R9 adjusts the input sensitivity. Adjusting R9 to midscale ensures maximum sensitivity, while each extreme is for digital or high level signals.

The input signal is shaped by IC13 to produce square waves. The circuit is a dual Schmitt trigger with adjustable threshold points. The values of R12 and R13 set the threshold to approximately 100mV, centred at half the supply voltage.

Capacitor C6 limits the frequency response above 100kHz to improve the signal to noise ratio. This capacitor may be left out of circuit if the counter will often be used for measurements above 100kHz.

Input scaling is accomplished with IC5 and IC4. Closing switch S2 scales the input signal by a factor of 10, allowing signals greater than 100kHz to be measured. Switch S2 also controls the displacement of the decimal point. IC14 decodes the digit select lines to position the decimal point.

IC12 is a CMOS five decade ripple counter that has its respective outputs multiplexed using an internal scanner. The outputs of each counter are selected by the scanner and appear on four BCD



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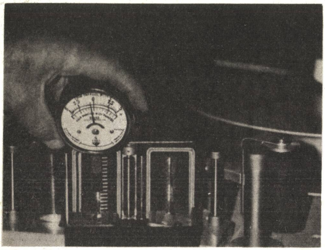

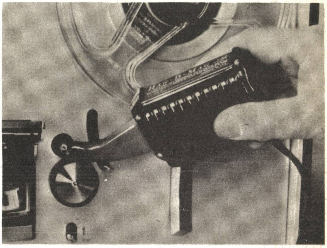

1 Check Magnetism in Recorder Components

The Annis Pocket Magnetometer quickly and accurately measures residual magnetism levels in recorder heads, drive capstans or tape guides. Indicates when it's time to demagnetize and lets you know when it's again safe to use the recorder.

2 Demagnetize Components When Necessary

Whenever the Magnetometer indicates any appreciable level of magnetism in a tape transport component, you can demagnetize it effectively with the powerful Annis Han-D-Mag before it causes permanent damage to recorded tapes.

● ● ● ● ● ● ●

Valuable audio and video tapes can be damaged when played on equipment that is not thoroughly and regularly demagnetized. Magnetism can easily build up in capstans, tape guides or recorder heads to a point where it will degrade the magnetically recorded signal on tapes passing over them. Tape damage is first apparent as a loss of recorded high frequencies and a progressive increase in background noise each time they are played on magnetized equipment.

Until recently, there has been no easy way to tell when demagnetizing was needed, and most Demagnetizers on the market were far too weak to be effective, particularly on offending hardened steel guides or capstans, etc. Now, with the introduction of the Audiophile Han-D-Kit, both measurement and correction problems can be solved easily at modest cost.

Here in one convenient package is everything needed to measure magnetic levels quickly, along with a handy, powerful unit to demagnetize components completely before they can spoil valuable tapes.

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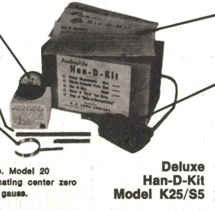

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Deluxe Han-D-Kit Model K25/S5 Same as above except for the Magnetometer. This kit includes the larger, more rugged Model 25 Jewelled Magnetometer with ten times the calibration stability of standard Model 20.

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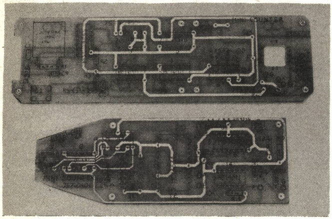
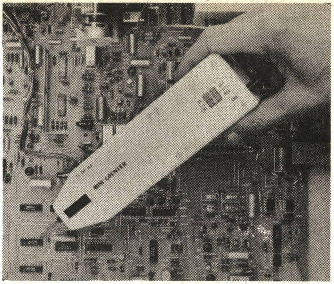
Mini frequency counter


Fibreglass PC boards are supplied as part of the kit. They are through-hole plated and labelled for component layout.



The Mini Counter fits easily into the palm of the hand for fast and accurate frequency readings.

pins. The selected decade is indicated by a logic high on the appropriate digit select pin. The scan rate is set by oscillator IC6c and IC6d. IC11 converts the BCD counter data to seven segment code and directly drives the common cathode LED displays.

IC9 is an NPN Darlington array used to buffer the digit select lines to the display.

The Mini Counter kit uses through-hole plated fibreglass PC boards to simplify construction. The boards are also silk screened and labelled for component layout, as shown in the accompanying photograph. A comprehensive wiring diagram is supplied as part of the kit, showing component overlay for the two PC boards and the wiring connections between them.

The only semi-skilled portion of construction concerns the switch assembly. This is taken care of by a separate diagram showing an exploded view of the assembly. The switches are complete with an interlocking pin and dual contacts.

The method of final assembly into the pre-punched plastic case can be seen from the photographs. The top board is mounted to the top half of the case using nylon screws, four 11/16in spacers and four 13/16in spacers. The bottom PC board and the bottom front of the case are then secured with nylon screws to the other ends of the four 11/16in spacers.

A small foam rubber pad must be placed between the battery and the switch assembly to prevent shorts and to secure the battery in position. Assembly is completed by securing the battery cover to the remaining spacers, again using nylon screws.

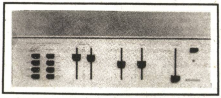
The only calibration necessary is to adjust capacitor CT in the timebase circuit for maximum accuracy. Perhaps the easiest method is to calibrate the counter by making comparison measurements with a frequency counter of known accuracy. Other calibration methods were described on page 37 of the March 1977 issue of "Electronics Australia".

However, even without calibration, accuracy of the unit is typically ±5 cycles at 1MHz. The prototype unit featured here has not been calibrated.

A range of optional extras will be available for use with the Mini Counter in the future. These will include a 60MHz prescaler, a voltmeter, and facilities for measuring capacitance and resistance.

A complete kit of parts for the Mini Counter 75T-0400 is available from Zephyr Products, 70 Batesford Rd, Chadstone, Vic 3148. Cost of the kit is $120.75 (including sales tax), plus $3.00 for packaging and postage.

RADFORD
High Definition Stereo Control Amplifier HD250



SPECIFICATION

Power output.
Rated: 50 watts average continuous power per channel, both channels driven, 4-8 ohms load.
Maximum: 90 watts average power per channel into 5 ohms load.

Recommended load impedance: Nominal 8 ohms loudspeaker.

Output source impedance: 0.1 ohms, in series with 2200 μF and 2μH.

Rated sensitivity.
Disc input: 2 mV at 1 kHz, RIAA equalised.
Line inputs: 100 mV, flat response.

Rated sensitivity is the input voltage required to produce rated output power with the channel gain (input level) control set to 0 dB and the volume control at maximum. This corresponds to 1 volt (0 dBv) at the pre-amplifier (line) output terminal.

Overload margin.
Disc input: 40 dB min.
Line input: 36 dB min.
Line output at clipping level: 18 V r.m.s. (+25 dBv) with power amplifier input disconnected.

Frequency response.
Disc input: RIAA deviation less than 0.5 dB (typically 0.2 dB) 50 Hz to 20 kHz (see Fig. 2). L.F. roll-off 12 dB/octave, –3 dB at 30 Hz.
Line input: 20 Hz to 32 kHz, –1 dB.

Hum and noise output.

	Condition (1)	(2)	
Disc:	–75 dBv	–80 dBv	Referred to rated sensitivity of 2 mV†
	–83 dBv	–88 dBv	Referred to 5 mV input
Line:	–80 dBv	–83 dBv	† see below.
	–85 dBv	–88 dBv	Input level controls at minimum
	–100 dBv	–104 dBv	Volume control at minimum
Signal-to-noise ratio at loudspeaker terminals:	97 dB	100 dB	Volume control at minimum

Note:
Condition (1) Measured flat with a 6 dB/octave roll-off at 15 kHz to provide a noise bandwidth of 23 kHz.
Condition (2) Measured with standard 'A' weighted characteristic.

† Noise is quoted as the voltage present at the line output terminal with the input level control set to 0 dB and the input short-circuited. As the noise is expressed in dB relative to 1 volt (dBv), the figures will also indicate the signal-to-noise ratio.

Tone control.
Bass: ±11 dB at 30 Hz } See Fig. 3.
Treble: ±12 dB at 20 kHz

Rise time: 6μs.

Frequency response and rise time are measured at rated output power level, with the tone controls neutral or cancelled.

Input impedance.
Disc: 47 K ohms.
Line: Nominally 27 K ohms, varying with input level control setting.

Distortion.
Disc amplifier.
at rated level: Zero*
at +20 dB: Zero*
Line amplifier.
at rated level: Zero*
at +20 dB: Less than 0.01% at 1 kHz.

* Cannot be identified or measured as it is below inherent circuit noise level.
Power amplifier.
at rated output: Less than 0.02% (typically 0.01%) 1 kHz.
at 25 watts output: 0.006% at 1 kHz. (See Figs. 9, 10 and 11.)

Total harmonic distortion is quoted separately for the disc amplifier, line amplifier and power amplifier. Under normal operating conditions, the power amplifier will be the only contributor of distortion.

Mains input: 100 V, 120 V, 130V, 220 V, 230 V, 240 V, 50-60 Hz.
Size: 17" (43 cm) wide, 4½" (11.5 cm) high, 11" (28 cm) deep overall.
Weight: 21 lbs (9.5 kg).

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MICROPHONES

Part 8: Microphone placement for choirs

Reproduced by courtesy of Sennheiser Electronics, this series of articles is intended to assist sub-professionals and amateurs who need to use microphones, but lack the advantage of formal acoustic training. This article discusses the various problems encountered when recording a large choir.

by G. PRAETZEL and E. F. WARNKE*

As a good example of some of the problems associated with recording in general, and stereo recording in particular, let us consider the need to record a large sound source, such as a choir or instrumental group.

Let us assume a choir of 50 people spread over an area about 5.5 metres wide by 2.5 metres deep, in a large room or hall with a long reverberation time. One point which would simplify such a recording is the fact that individual voices, as distinct from musical instruments, fall in a similar loudness bracket.

As a test, let us place a pair of MD 421 microphones about 2.5 metres from the first row of singers, the microphones angled at about 105° to each other. What results should we get from this arrangement?

The nearest singers are only 2.5 metres from the microphones, while those in the back row are about 5 metres away. This would result in a difference of more than 8dB between the two groups or, in simpler terms, the front row singers would override those in the rear.

On the other hand, the presence, at least of the front row singers, would be satisfactory, but there would not be enough reflected signal to give a satisfactory reverberation balance.

One suggested solution to this problem is to increase the distance between the microphones and the group until the difference between the front and rear rows is minimised. But to reduce the difference to an acceptable figure, say 3dB, it would be necessary to place the microphones about 7 metres from the front row.

The result would be to virtually eliminate any presence and to cause the reverberation to prevail over the direct sound. So it would seem that we must either tolerate an excessive difference in level between front and rear singers in order to preserve presence and control reverberation, or sacrifice presence and reverberation control in an effort to balance the voices.

In fact there is a better solution; it is to place the microphones above the choir. Using the original microphone location—2.5 metres from the front row—we lift the microphones to a height of about 5 metres. With this arrangement the distance from the front row is about 4 metres and to the back row about 5.5 metres; a much smaller distance ratio. This would reduce the sound level difference to an acceptable 3dB.

A further improvement would result if, as is often desirable in terms of visual presentation, the back row(s) could stand on a higher level than the front rows.

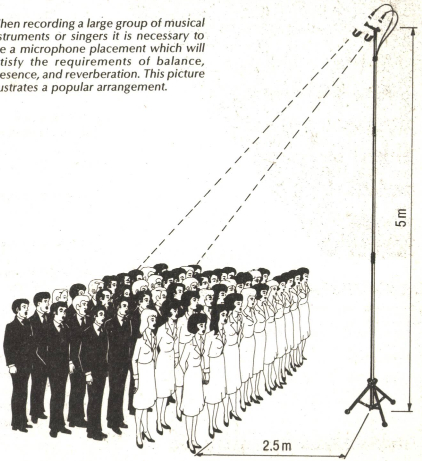
Such an arrangement will almost guarantee good balance and presence, but it may not provide sufficient reverberation. Since good artificial reverberation systems may be beyond the financial scope of the amateur, other means must be employed if the carefully established presence and balance are not to be disturbed.

The solution is to use another set of microphones to capture the reverberation. The suggested set-up uses two more MD 421 microphones placed 10 to 15 metres from the choir and facing away from it. It is further suggested that the left hand reverberation microphone be mixed with the right hand main microphone, and vice versa.

A mixer for a set-up such as this must satisfy certain requirements. For the choir described, and allowing for fortissimo levels, we can expect a minimum sound pressure of 10ubars, or about 2mV from the MD421 main microphones.

Against this, the reverb microphones would experience less than 1ubar, giving an output of 0.1mV. On this basis the mixer should have a sensitivity of at least 0.1mV, with a signal-to-noise ratio of not less than 60dB.

When recording a large group of musical instruments or singers it is necessary to use a microphone placement which will satisfy the requirements of balance, presence, and reverberation. This picture illustrates a popular arrangement.



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For amateur radio operators

Simple solid state RTTY modulator

As a sequel to the RTTY Demodulator presented in the March, 1977 issue, we present here a companion RTTY Modulator. The design is again based on the economical LM3900 quad op-amp, and is assembled onto a small printed circuit board which can be fitted into the case of the RTTY Demodulator.

by DAVID EDWARDS

While the previous project could be built and used by any enthusiasts with access to a suitable teleprinter, this project should really only interest licensed amateur radio operators, as it is intended to be used in conjunction with a transmitter.

The function of the project is to convert the coded information present at the teleprinter keyboard switch contacts into a frequency shifted audio tone, which is intended to replace the microphone signal in a transmitter. The type of signal so generated is known as AFSK (audio frequency shift keying).

Before discussing the design of the unit in detail, it is perhaps desirable to give a brief discussion of the requirements and standards to be met. Normal RTTY practice is to use a 2125Hz tone to represent the "mark" signal (i.e., keyboard contacts closed), and a 2975Hz tone to represent the "space" signal (i.e., keyboard contacts open).

These tones correspond to a frequency shift of 850Hz. For lower value shifts, as used by many radio amateurs, normal practice is to leave the mark frequency unchanged, and to lower the space signal in frequency by an appropriate amount.

In order to minimise spurious radiation, there should be minimal keying transients, and the tones themselves should be reasonably pure, without excessive amounts of harmonics. The output signal should be adjustable in level, to suit various input signal requirements. Finally, construction should be simple, with facilities provided for more than one frequency shift.

Turning now to the circuit diagram, we can discuss the operation of the unit. The teleprinter keyboard switch controls TR1, a BC548 transistor, via the debounce circuitry formed by the network connected to the transistor base. TR2, a second BC548 is used to invert the debounced keyboard data present at the collector of TR1.

The two complementary collector signals are used to gate two oscillators in synchronism with the keyboard data. These oscillators are formed from amplifiers 1 and 2 of the LM3900 quad op-amp. Each oscillator is adjustable in frequency independently of the other.

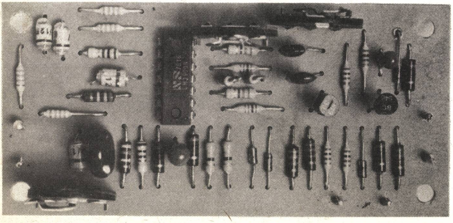
Neglecting for the moment any current flowing into the positive input via the diode, each oscillator can be recognised as a Schmitt trigger controlled square wave generator. The 0.01uF capacitors alternatively charge and discharge via the 15k fixed and 22k variable resistors.

During a mark signal, the base of TR1 is held low, and hence the collector of TR1 is high, while that of TR2 is held low (TR2 is turned on). D3 is forward biased, and allows a relatively large current to flow into the positive input of amplifier 1. This current swamps the currents due to the positive feedback and bias resistors, and forces the oscillator to stop. The amplifier output is also forced high.

Conversely, D4 is reverse biased, and allows the mark oscillator to operate. When the input signal becomes a space, TR1 turns on and TR2 turns off. This allows the space oscillator to operate, and forces the mark oscillator to stop, with its output again at a high level.

Amplifier 3 is connected as a bandpass filter. It has a Q of about 0.86, a gain of about 0.74, and a centre frequency of about 2700Hz. The upper and lower −1dB points are 3300Hz and 1950Hz respectively, which gives a very flat response for the frequencies normally used.

Amplifier 3 also serves to combine the



Shown at left is the completed board assembly. Note how the two frequency determining trimpots are mounted.

The circuit diagram for the RTTY Modulator is shown at the right. It is based on the LM3900 quad operational amplifier.

two oscillator outputs into a single signal. This is achieved in the following manner. Normally, one of the 680k input resistors is returned to signal ground, with the other 680k resistor serving as the input resistor. When the space oscillator is forced off, its output is forced high, and functions as a ground for the signal from the mark oscillator.

Conversely, when the mark oscillator is stopped, its output acts as an AC ground for the signal from the space oscillator. This arrangement has two benefits. Firstly it uses no extra components, and secondly, because one of the inputs is always connected to a high DC signal, no transients are generated when the oscillators stop and start.

Amplifier 4 is connected as a second order Butterworth low pass filter. It has a cutoff frequency of 3000Hz, and unity gain in the pass band. The input signal is DC coupled, and the bias resistor (connected to the non-inverting input) has been chosen to give a DC output voltage of half the supply rail.

The output signal is AC coupled into a 10k preset potentiometer, which functions as the output level control. The maximum signal level available at the output is about 1.5V RMS, which should be more than enough to drive virtually any transmitter.

Measurements on the prototype with the mark and space oscillators set for 2125 and 2975Hz respectively (i.e., wide shift) showed that there was a 2.5dB difference in signal level between the space and mark signals—the space signal being lower. This is mainly due to the Butter-

PARTS LIST

SEMICONDUCTORS

1 LM3900 quad Norton op-amp
2 BC548 NPN transistors, or equivalent
4 1N914, 1N4148 or similar silicon diodes

RESISTORS (all ¼W)

4 1k, 1 3.3k, 4 10k, 2 15k, 2 33k, 1 479k, 2 689k, 5 1M, 2 3.3M, 2 4.7M, 2 10M
1 10K trimpot (0.2" lead spacing)
2 22k trimpots (0.2" lead spacing)

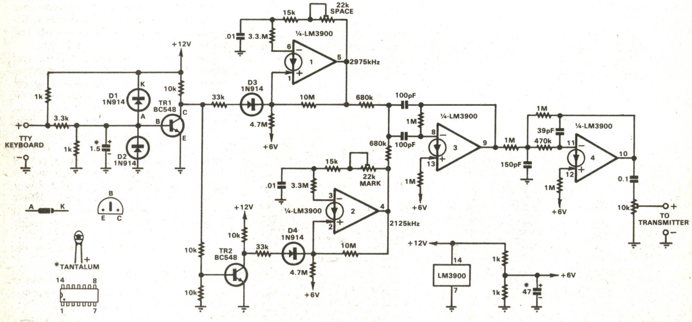
CAPACITORS

1 47uF 6.3VW tantalum electrolytic
1 1.5uF 35VW tantalum electrolytic
1 0.1uF polyester
2 0.01uF polyester
1 150pF polystyrene
2 100pF polystyrene
1 39pF polystyrene

MISCELLANEOUS

1 PCB, coded 77tty6, measuring 96 x 45mm
4 9.5mm (⅜") PCB standoffs
Input/output connectors (see text)
Solder, PCB pins, rainbow cable

NOTE: Resistor wattage ratings and capacitor voltage ratings are those used for our prototype. Components with high ratings may generally be used provided they are physically compatible.



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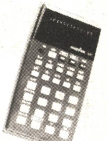

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worth filter, and could be reduced somewhat by increasing the cutoff frequency of the filter.

However, this would reduce the filter's ability to reject the harmonics of the mark signal, especially the second harmonic at 4250Hz. (This second harmonic is present because the oscillator outputs are not ideal squarewaves). We feel that the cutoff frequency chosen gives the best compromise, considering that with narrower shifts (i.e., 170Hz) the level difference is much smaller.

We measured the distortion of the output signals at about 5%. We were unable to make meaningful measurements of the transients present when a frequency change occurs, but observations on a CRO showed them to be very small.

The circuit is powered from a single 12V rail, with two 1k resistors and a 47uF tantalum bypass capacitor used to derive the 6V rail needed to bias the amplifiers. The total current drain of the circuit is about 20mA. This is sufficiently low to enable operation from the regulator used in the demodulator.

All the circuitry has been accommodated on a small printed circuit board, coded 77tty6, and measuring 96 x 45mm. As you can see in the photographs, this board can be fitted into the case used for the demodulator without any modifications.

Construction should not present any major problems. Use the printed circuit board overlay diagram as an aid to placement of components, remembering to use a minimum of heat and solder. We recommend the use of the circuit board pins for the external connections, as the copper tracks are very thin, and can easily be displaced if care is not taken.

On the circuit diagram, we have not shown any details of the plugs and sockets required to connect to the teleprinter and the transmitter, as we felt that this was best left up to the individual constructor.

On the prototype a 270 degree 5 pin DIN socket was mounted on the rear of the case for the teleprinter connections, directly underneath the tape socket. The 6.5mm phone sockets were retained.

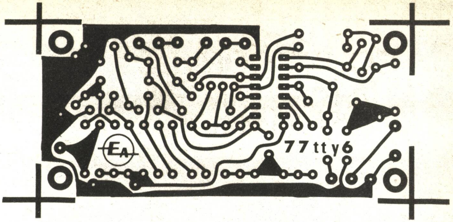
The phone socket formerly used as the teleprinter output was rewired for use as the modulator output, so that connections to and from the transmitter/receiver were all made with 6.5mm phone jacks. The new DIN socket was wired to connect to the teleprinter, with the keyboard connected between pins 1 and 2, and the printer drive between pins 4 and 5.

This means that the 68 ohm resistor which was formerly switched by the TTY output socket cannot be used. Instead, a 150 ohm resistor was permanently wired across the DIN socket. This allows the monitor LED to operate without a TTY connected, but does not limit the current available to the printer driver circuit when a TTY is connected.

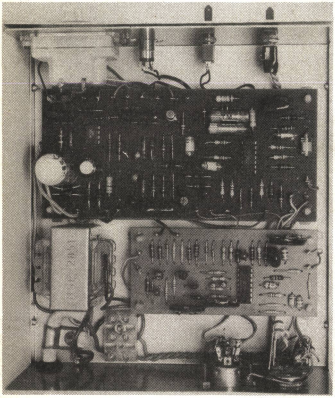
Once construction is completed, the unit can be tested and adjusted. When power is first applied, monitor the supply rail and switch off if 12V is not present. If desired, the current can also be monitored. With the TTY keyboard terminals short circuited, the mark oscillator should operate. Adjust the 22k trimpot to achieve the correct output frequency of 2125Hz.

With the TTY keyboard terminals open circuited, adjust the space trimpot for the correct space frequency. For an 850Hz shift, set it to 2975Hz, and for a 170Hz shift, to 2295Hz. If you wish to use more than one shift, the space trimpot can be replaced by a switch and the appropriate number of trimpots.

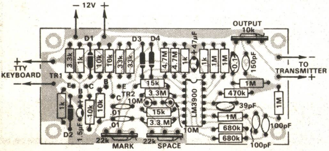
Finally, adjust the output level to suit your transmitter. And that completes construction, so all that remains is to wish you happy RTTY operating!



ABOVE: The printed circuit board pattern is reproduced here full size, and may be traced if desired.



LEFT: This photograph shows how the new board fits into the case for the RTTY Demodulator described in the March, 1977 issue.



BELOW LEFT: Use this diagram as an aid to the placement of components on the printed wiring board.

Troubleshooting the 1976 car burglar alarm

If you have considered building the Car Burglar Alarm described in the November 1976 issue, but have felt diffident about working with ICs, or trouble shooting the circuit if it did not work first go, then this article should set your mind at rest. It describes a simple step by step test routine which anyone should be able to follow.

by IAN ROBERTSON
36 Hume Drive, Helensburg, N.S.W. 2508

This car burglar alarm (File No. 3/AU/16) has attracted a good deal of interest, and has been built by readers spanning the full range of kit building experience. A number of readers have asked about testing the alarm so I have set out the method I have used on a number of units built by friends.

Also, I have had cause to revise the value of some resistors feeding the relay and indicator drive sections. It appears that my original calculations were somewhat astray and I recommend the following values be altered.

(a) Resistor to pin 13 of A4 was 100k now 180k

(b) Resistor to pin 13 of B4 was 100k now 15k

(c) Two resistors, pin 8 of B4 were 150k now 22k

(d) Anyone needing continuous horn operation should make the resistor between B3 pin 10 and B4 pin 8 10k not 68k.

In fact, a number of alarms built by both myself and friends have functioned satisfactorily using the original values. The problem is one of input parameter spreads, the original data being somewhat lacking in detail in this respect. As a result the problem showed up in some devices only, others operating quite satisfactorily.

After changing the resistors check the wiring between the PC board and the terminal block. Details are given in Fig. 1 for relay coils above 500 ohms and in Fig. 2 for relays 100 ohms and above.

At this stage the unit should operate when installed in a car. However, I recommend setting up a test circuit (Fig. 3) to test the alarm before fitting it into the car. Should a fault be found repair will be easier. A multimeter should be all the test equipment needed.

The 12V for testing may be obtained from the car's own battery, in situ, or more conveniently from a battery on the work bench. Alternatively, a bench power supply may be used, with the restriction that it may not test the battery detector circuit in all respects.

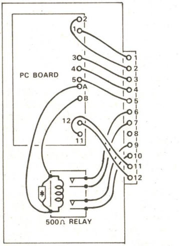


FIG. 1

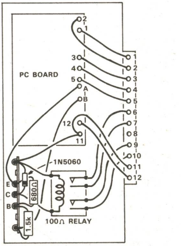


FIG. 2

A simple driver stage must be added for relays with a coil resistance of less than 500 ohms (Fig. 2). Circuit details were on p71 of the February issue.

Steps for testing using Fig. 3 are:

(a) With the power and accessory switches on, check to see that neither the indicator or relay are energised.

(b) Move the accessory switch to off and the indicator and relay should remain off.

(c) Momentarily operate the push button. This should set the alarm, and the LED indicator should light for a period of 12 seconds, i.e., the exit time.

(d) After the exit time the indicator should flash at half second intervals, showing the alarm is set.

(e) The alarm may now be triggered by means of the battery detector—open a car door if the car battery is being used or with a bench supply momentarily turn the 240 volt mains off then on. If a bench battery is being used connect a load, say a 15W lamp, across the battery.

(f) The six second enter delay should now occur, followed by the horn relay pulsing at half second intervals for a period of up to two minutes.

(g) At any time during the above sequence, closing the accessory switch should cancel the alarm, forcing the relay and indicator off.

The preceding describes what should happen. If a fault is present, it will usually be traced to a single malfunctioning section.

A thorough visual inspection is the first requirement. Check the value and placement of all resistors. These should be 5% (gold band) up to 1M. Above this 10% (silver band) may be used if necessary.

Make certain the capacitors are as specified and correctly oriented. The colour bands on the TAG capacitors are: 4.7uF—yellow, violet, pink, with white dot; 47uF—yellow, violet, yellow, with black dot; 22uF—red, red, green, with black dot. These are read from the top with the leads downwards and the positive lead to the right of the dot.

Identifying ceramic capacitors has reached the stage where I make increasing use of a capacitance bridge—the 0.1uF could be marked 0.1, or 104 (10 and 4 zeros, or 100,000pF), or 100n (100 nanofarads).

Check the diodes and replace if the body glass is broken. Diodes are best mounted above the board with the leads bent some distance from the body and then shaped to the pitch of the board holes.

Before delving too deeply into the circuit, swap ICA and ICB (practicable only if mounted in IC sockets) and determine if there is any alteration in the circuit operation: it may happen that one IC will enable testing to proceed to where the light flashes, while the second IC keeps the light fully on (or off) meaning the second IC is faulty.

In general I prefer stage by stage testing, using a multimeter or oscilloscope. By this method the output of each amplifier is checked in turn to locate the faulty area.

As an aid to fault finding I will briefly outline the operation of the LM3900 op amp for any reader not familiar with this device.

Each amplifier has two inputs and one output; the inputs are the inverting input and the non-inverting input (negative and positive respectively). In the case of the LM3900 the state of the output, ie, whether the output is driven towards the positive or negative supply rail, is determined by the magnitude of currents flowing in the inputs.

If the current in the inverting input exceeds that in the non-inverting input the output is driven towards the negative rail. If the current in the non-inverting input exceeds that in the inverting input the output is driven towards the positive rail.

As with the majority of op amp circuits, extensive use is made of feedback from the output to the input. The feedback may be either positive or negative, i.e., the feedback may either assist or oppose the input signal.

Reading the original article should give an idea as to how the individual sections make use of these fundamentals.

A quick look at the input circuit of the LM3900 would tell the experienced constructor that little information can be gleaned from the voltage levels present, because all inputs are clamped to within 0.5V above negative by the base emitter junction of the input transistors.

Fortunately other ways of testing the inputs are available.

These are:

(a) Short any input, inverting or non-inverting, to negative.

(b) Drive any input, inverting or non-inverting, from the positive rail via a series resistor of, say, 10k.

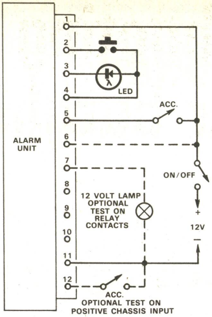


FIG. 3

Test circuit for the assembled alarm. The lamp is optional; other dotted lines are for the positive chassis version only.

By this means individual amplifiers can be checked (without reference to the remaining circuit conditions) by simply overriding the normal input currents and checking that the output swing is high or low, as expected. Putting it another way, a positive bias can be given to any input by overdriving the input with a resistor from positive or, alternatively, shorting the opposite input to the negative rail.

The general fault finding procedure is to isolate the malfunctioning stage using the following sequence. Once isolated, all items in the section are suspect and a concentrated inspection must be made.

Begin by deciding if the functions associated with ICA are working and then move to ICB functions. In general, if steps (a) to (d) in the test sequence (given earlier) are normal then ICA is OK, while steps (e) to (f) relate to ICB, but ICA must be OK before ICB can be checked.

When the fault seems to be in ICA proceed by attaching the negative lead of a voltmeter to negative, and with the positive lead confirm there is 12 volt at the input terminal 4, Fig. 3.

Place the voltmeter positive probe on the output of the oscillator (ICA pin 10) and check for oscillation—half second on, half second off. Move to the output of the bi-stable (ICA pin 4) and check this is low (less than 0.75V) with the accessory switch on.

With the accessory switch off the output should go high (greater than 11V), but only after the pushbutton is pressed.

Repeating the previous two steps with the probe on the output of the exit delay (ICA pin 5) should give a similar result, except that the output swing is inverted; ie, the output is normally high, going low after a 12 second delay when the push button is pressed.

If a direct coupled oscilloscope with a 10:1 probe is available the charging of the 22uF capacitor can be watched throughout the 12 second delay.

The next stage to be checked is the indicator driver (ICA pin 4). The LED should be flashing if the previous sections have tested OK, ie, up to the completion of the exit delay cycle, when ICA pin 5 goes low.

As an additional check the meter probe may be placed on ICA pin 9 and the output of the driver observed. The meter should swing between the high and low states, for half second periods. A normal swing can go to within 2.5V of the negative rail in the low state and above 11 volts in the high state.

Any problems encountered in these functions must be overcome before proceeding to the ICB functions. I hope the methods given near the beginning of this article will help in locating and overcoming any faults that are found.

Once the fault has been isolated to a section controlled by ICB, a similar stage by stage check may be made of this area. Place the meter probe on the output of the battery detector (ICB pin 4). This should be low while ever the accessory switch is on.

Turn the accessory switch off, operate the push button, and wait until the indicator flashes, signifying the alarm is set. The output of the detector should still be low.

The detector may now be triggered in the manner outlined in section (e) of the test sequence or alternately connect pin 3 of ICB to negative. Once triggered the battery detector output goes high and the enter delay capacitor begins to charge, giving a six second delay before the horn mono-stable is set. Operation of the horn mono-stable may be checked at pin 10 of ICB. The output should go high and remain high for at least 90 seconds.

It may be necessary to repeat the above sequence a number of times with the meter on pin 4 or pin 10 as required. If an oscilloscope is available the charging of the capacitor may be watched. It should charge slowly for six seconds and then quickly discharge as the horn mono-stable operates.

The horn mono-stable remains high for a period greater than 90 seconds and during this time the 100uF capacitor is slowly charged until sufficient current enters the inverting input to drive the mono-stable output low.

If a problem exists with the mono-stable, it may be an advantage to reduce the 100uF capacitor value to, say, 10uF. This will give a much reduced mono-stable time, enabling the fault to be found more quickly. As before, the state of charge may be checked if an oscilloscope is at hand.

As a final check the output of the relay driver may be tested (ICB pin 9). The procedure is the same as for the indicator driver, that is, the meter should swing between the low and high states, for half second periods. A normal swing can be taken to be within 2.5V of the negative rail in the low state and above 11 volts in the high state.

Forum

Conducted by Neville Williams

Can amateurs & CBers get together?

What follows, this month, may well have been accepted to a degree by the time it appears in print. Or it may have been ruled completely out of court, in which case it can stand as some kind of a memorial to what might have been, in the saga of CB radio in Australia.

One of the most obvious aspects of Citizens Band (CB) radio in Australia, as elsewhere, has been the rivalry which has been generated between CBers, or would-be CBers, and licenced amateur operators.

Many amateurs have seen CB radio as a significant watering down of the skills, the rights, the responsibilities and the mystique of those permitted to operate privately owned radio transmitters. Because the status of licenced amateurs would cease to be unique, their rather tenuous hold on international frequency allocations would be in greater jeopardy.

For their part, CBers have tended to regard amateurs as a self-styled elite, parading their technical skills but, in reality and for the most part, using their equipment for purely communal small talk. But because amateurs by tradition had the ears of many administrations, they were in a position to interfere with and frustrate the champions of the CB concept. They were seen therefore as enemy number 1, and symbolised here by the Wireless Institute of Australia—the WIA.

Rivalry between the two groups built up during 1976, probably reaching its climax during the end of the year holiday period. With free time on their hands, stirrers from both sides resorted to jamming, abuse and threats of physical violence, with generous contributions from others who professed to have no regard for the ethics of either amateur radio or conformist CB clubs.

Since that time, it has become plainly apparent that the stirring could only damage both causes and that the "ratbag" element might easily push the Government into an active campaign against all CB-type activity, as well as denying 27MHz to novice amateurs, or even amateurs of any kind.

It was also becoming evident that, far from diverting people from amateur radio, CB activities was in fact providing a pool of potential recruits. While many unlicenced CBers seemed content merely to put up with the crowded conditions on 27MHz, many others could see the rewards of becoming at least a novice amateur and gaining access to other parts of the spectrum.

This ambition has now been strengthened by the official statement that the 2-year tenure limit, which had originally applied to novice licences, has been dropped.

It is not surprising therefore, to discern an emerging willingness to seek common ground between amateurs and would-be CBers, with the ultimate aim of securing orderly, rational use of the 27MHz band.

There are various ways in which such an objective might be achieved and these have been canvassed at various times and places. One proposition which has been put to the Minister, however, envisages the creation of a fourth type of amateur licence which would hopefully provide an answer to the aspirations of CBers, the interests of amateurs, and the present dilemma of the authorities. It has overtones involving a liberalising of the existing novice type of licence, as will be apparent.

What follows is a precis of a submission to the Minister by Sam Voron, VK2BVS. As we said at the outset, it may all be redundant by the time you get to see this but, in any case, it makes interesting reading.

Sam Voron, by the way is an active amateur, a member of the NSW WIA, of the YRS (Youth Radio Services), the Novice Amateur Radio Group, University of NSW Amateur Radio Club, and the Sydney DX group, as well as his association with the CB cause. We quote:

SUBMISSION TO THE MINISTER (PRECIS)

The Minister for Post and Telecommunications,
The Hon. E. L. Robinson,
Parliament House,
CANBERRA 2600 A.C.T.

Dear Sir,

Since my last letter dated the 3rd. February, 1977, I have been attending meetings with members of both the citizen's radio and amateur radio movement. Enclosed are additional signatures to indicate the continuing discussion in respect to a D-class or 4th. class licence. The letter of the 3rd. February, has been circulated to amateur and citizen radio clubs around Australia, as will this final submission.

MEETINGS: On the 17th. February, 1977, I attended a meeting where representatives of citizen radio clubs from around Australia met in Sydney to form the National Citizen's Radio Association (NCRA) as the national voice for citizen's radio activities in the country. The structure, financing, aims and mechanism of operation was agreed to by those present who represented 6010 operators in citizen radio clubs around Australia.

On the 19th. February, 1977, I attended a meeting between the Federal President of the WIA David Wardlaw and the NSW Divisional WIA CB investigation group. On the 23rd. February 1977, a meeting took place between the NCRA Director and the WIA NSW Divisional President, Tim Mills VK2ZTM, the Novice Amateur Radio group President Brian Belcher and Vice President Peter Vernon VK2PV, as well as representatives of the WIA CB investigation committee.

On the 26th. February, 1977, a public meeting with official NCRA and WIA speakers was held at the Ryde Civic Centre where 400 citizen and amateur radio operators attended.

SUSPICIONS DIMINISHED: As a result of these and other discussions I believe that the distrust between citizen and amateur radio operators has been largely removed, especially between the Executive of the NCRA and the WIA NSW Division as well as at the CB operator level.

CB DEFINED: From my discussions with operators in clubs around Sydney, I can again state that CB is seen, by those who use it, as being a recreational hobby communications and community service activity.

Most of the activities which the CB movement is engaged in illegally could be pursued legally with a novice amateur licence. What is being questioned by the CB movement is the necessity for the hobby novice licence requirements of

Morse code and electronics theory for the ordinary Citizen who is prepared to use only approved commercial equipment on a limited range of frequencies.

The concept of short range communications for business and personnal non-hobby users, as defined by American CB, does not apply to the majority of users in Australia, although in rural areas this concept has been reported to be in operation.

LEGISLATION SOUGHT:

1. A "communicator" amateur D-Class licence to cater for those interested in recreational hobby communications and community service activities on the 27MHz band.
2. A short range business and personnal non-hobby service on the UHF band. (Until equipment is available at reasonable cost and performance a shared allocation could be assigned on the 27MHz band).

SUGGESTED D-CLASS LICENCE CONDITIONS:

1. Use of type approved 23-channel equipment.
2. No internal transmitter adjustments allowable except by amateur licence holders.
3. Power limited to 5 watts DC input on AM and 15 watts pep input on SSB coinciding with equipment currently available.
4. Communications limited to within Australia.
5. The voluntary setting aside of channels for specific purposes e.g. channel 9 as an emergency calling channel, channel 14 as a general calling channel, channels 12, 7 and 5 for low power hand-held units, channels 16 to 23 generally SSB, channels 15 to 1 generally AM. The general calling emergency channels would be the only ones set aside by regulations.

   The alternative to (1) is to say that CB is a recreational hobby communications and community service activity for the citizen with a very limited technical background, while saying that amateur radio is for those with a larger amount of technical background engaged in the same recreational hobby activity. This would have the effect of separating two groups on a class basis—a situation which would breed antagonism. A communicator licencee should be permitted to engage in the hobby of recreational radio communication with the restriction that only type approved equipment be used, as is the case in the Netherlands D Class amateur licience.

OTHER CONSIDERATIONS

6. Limited licencee holders should be permitted use of the 27MHz band. There is no common frequency band at present on which novice, limited and fully licenced hobbyists can meet. The limited licencee represents a section of the total amateur resource which can join in assisting the newly licenced communicator licencee. It should be noted that The International "no Morse" concession for amateur operation on frequencies above 144MHz has been dropped to all frequencies above 52MHz in Australia; it should therefore be possible to further drop the no Morse requirement to frequencies above 26.960MHz.
7. The third party restriction in relation to amateur community service activities should be relaxed. International regulations state that the third party restriction on the amateur radio service can be wavered by the national administration.
8. The two year tenure on the novice licence should be removed.

   (The tenure limit has, in fact been removed. Ed.)
9. Novice licencees should be permitted use of 28.1 to 28.2MHz which has been allocated to novice licencees in the United States and soon in Canada as well as 28.5 to 28.6MHz which is the proportion where most contacts are initiated in the 10 metre band. These new allocations would provide the novice operator with additional operating flexibility especially during times of crowded conditions on the 27MHz band.
10. Novice licencees should be permitted use of variable frequency oscillators (VFO). In the United States novice licencees are no longer required to be limited to crystal oscillators and are allowed use of a VFO; this recognizes the fact that most novice operators are using commercial equipment containing a VFO.
11. In the United States all classes of amateur operators who operate on the novice bands were, from last year limited to the novice power level, this could be made the case on 27MHz if this were found to be necessary.
12. Removal of the age limitation on the granting of full and limited licences to encourage novice and communicator licencees to study for the full and limited examinations. There has never been an age limit on any class of amateur licence in the United States.

CLASS D COMMUNICATOR LICENCE:

1. No tenure period to apply.

   The strongest incentive to upgrade comes from contact with individuals who function in a wider sphere of privileges. The simple presence of communicator, novice, limited and full licencees operating on the 27MHz band would act as a tremendous incentive to learn and to develop a desire to be able to do more as an individual.
2. No age limitation.
3. No morse code requirement.

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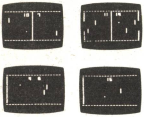

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graphy has been overcome in Japan and Canada. In Japan a different interpretation has been placed on section 3 (i) of article 41 (paragraph 93) of the radio regulations annexed to the International Telecommunication Convention (See QST Magazine, November 1975 page 50). As a result of this 87.64% of Japanese amateurs operate on the high frequency bands without a knowlege of Morse Code. They are permitted all bands except 14MHz using voice only and antenna power limited to 10 watts, using their radio telephone class of amateur licence. In Canada a new class of amateur licence requiring no Morse on the HF bands has been proposed

4. Examination appropriate to licence. A standard practical and regulations booklet should be made available through post offices. This would include a limited multiple choice set of questions which would relate to amateur radio regulations including the communicator licence. Additionally a limited multiple choice practical set of questions should be related to the problems that an operator is likely to encounter. Nowadays this means installation, connection to power supply, connection to an aerial system and its adjustment and minor front panel tuning of a commercially manufactured set. Radio Operating in relation to propagation and interference—all in a very practical non-technical level. There appears to be no reason to require a communicator or citizens amateur licence holder to understand such things as how the internal circuits of a transceiver are designed and put together.

WIA-NCRA COOPERATION:

The radio club as represented by the WIA together with NCRA represents a combined resource potential which could well be employed in the areas of examinations, self policing, interference prevention and elimination.

The NCRA (WIA affiliated)—communicator orientated clubs in conjunction with existing WIA clubs around Australia could offer a system of examining and licencing many thousands of people which could not be handled by the limited staff available to P & T at present.

Standard procedures in the conduct of examinations and the issuing of licences by radio clubs would be specified by P & T. Safeguards and monitoring techniques such as random selection and re-examination of licencees could be employed by P & T to ensure against irregularities, as is done by the FCC in their volunteer examination program which permits thousands of novice examinations to be given each year. The WIA Youth Radio Clubs Scheme has for some years been studying the possible introduction of this type of examination and licencing system being introduced and would be almost certain to be re-organised to meet and participate in this type of situation.

INTERFERENCE: In the case of interference, once a complaint is received by P & T, which seems to indicate amateur type interference, the name and address of the complainant would be passed on directly to the radio club in the interference area or to the club via state NCRA as the co-ordinating body responsible for following all such reports to a successful conclusion.

IN CONCLUSION:

In Japan, a radio telephone class of amateur licence exists (representing over 80% of all amateurs in Japan), while the Japanese equivalent of the Australian novice licence called the radio telegraphy class, represents only 7% of Japanese amateurs. In the United States a communicator class of amateur licence has been proposed by the FCC and accepted by the ARRL while at the same time the American novice examination is significantly easier than its Australian equivalent. In the Netherlands, a class-D amateur licence has been introduced.

In these countries they have begun to take advantage of equipment which calls for minimal technical knowledge, capable of providing the ordinary citizen with a stepping stone into the ranks of amateur radio.

Sam Voron
(For the Citizens Amateur Radio Movement)

OTHER POINTS OF VIEW

- Marketers of CB equipment are saying that submissions from amateurs and present day CBers alike are unreal in that they assume future users will be like themselves: people with some kind of an empathy with electronics who are prepared to think in terms of examinations, formalities, club membership, etc. In fact, they will be members of the public who will expect to buy and use CB gear with no more commitment than they presently buy a stereogram or a portable radio.
Further, that nation-wide CB clubs are a pipe dream—a few enthusiasts doing all the work, while others merely make up the numbers. No constitution, no money, no substance . . .
- Uncommitted technical experts are apprehensive that major impact of CB will not be what goes on inside the 27MHz band but what will happen to neighbourhood audio equipment and TV sets as the number of transceivers multiplies.
- See also "the Amateur Bands" by Pierce Healy, elsewhere in this issue.

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The Serviceman

Symptoms on the TV screen

While it goes without saying that observation plays a very important part in service work, the extent to which this applies is not always fully appreciated. A change in performance which may be too subtle to define clearly may still provide a vital clue which will save precious time by avoiding false trails.

It has often been said of faulty TV sets that they have an advantage over other types of electronic devices in that they are equipped with their own fault finding CRO: the picture tube.

Like many such statements it tends to be rather sweeping but it is true that a lot can be learned about a faulty TV set simply by looking at the screen—assuming one knows what to look for.

The usefulness of such observations was demonstrated in a recent case involving a colour TV set. It was a new Philips set, using a K9 chassis, which I had installed in the customer's home only a few days before.

The complaint was in the form of a phone call to the effect that the picture had developed a marked yellow cast. And, as might be expected, the customer was somewhat disturbed that such a—to him—serious fault could develop in such a short time. So, even though it was late in the afternoon, I hurried off to see what I could do.

A glance at the screen confirmed the customer's description; the picture had a most pronounced yellow cast. Even at this early stage, the colour itself told me something about the fault. Yellow is not one of the primary colours in a TV system, which are red, green and blue. More exactly it is a mixture of red and green and from this it is not hard to deduce that the fault probably involved the blue gun or its associated circuit, causing the blue to be suppressed.

(Had the red gun not been operating the picture would have had a cyan cast and failure of the green gun would have produced a magenta cast.)

As a result of this preliminary analysis I commenced by checking the voltages on the blue gun. The cathode voltage was normal, as was the G2 voltage. The control grid was another story. The control grids of the red and green guns were normal at a little over one volt positive, but for the blue gun was –70V. Little wonder the latter wasn't working.

My next check was to patch a clip lead between the blue grid and the blue cathode, which immediately produced a blue raster, with retrace lines, but less modulation. This established that the picture tube and socket were functioning correctly.

This shifted suspicion to the colour difference amplifiers and, more specifically, the clamping circuits associated with them. It seemed to me that a likely suspect was the "blue" diode, D320, in parallel with the 10M resistor, R321. I checked this with the ohm meter along with its "red" and "green" companions, and they all seemed to have normal forward and reverse behaviour.

By now it was getting quite late and, with the prospect of the job turning out to be a bit more complicated than I had imagined, I suggested to the owner that it would be better if I took it back to the shop. I reckoned that if I "slept on it" and came back fresh in the morning I might fix it a lot quicker.

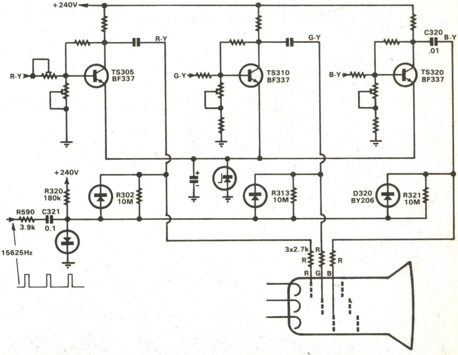
In fact, as I left the shop I grabbed the circuit description manual with the idea of brushing up on this part of the circuit. With a bit of luck, I might even be able to nominate the likely culprit.

Later that evening I spent some time studying the breakdown of that portion of the circuit, and refreshing my memory on its operation. The colour difference amplifiers are AC coupled to the picture tube grids, so it is necessary to provide a DC restoration circuit. This is done by using positive-going flyback pulses to establish a black reference at the end of each horizontal scan period.

The positive going pulses are fed to a .1uF capacitor (C321) through a 3.9k resistor (R590). Current from the pulses flows to chassis through diode D321, charging C321 to about 75V with its positive side towards R590 and its negative side towards R320. After the retrace pulses cease, and during the scan period, the charge of C321 provides a reference level of about –75V for the picture tube grids. In the absence of any video (chrominance) signal, ie, a black picture, the grids would remain at this level.

In more normal circumstances, with a typical picture on the screen, the voltage measured on these grids is about 1.5V—a figure similar to that which I had already observed on the red and green guns.

The –75 grid reference voltage is applied to the grids via a network of three 10M resistors, one for each grid. (R302, 313, 321.) In parallel with each resistor is a diode—the one I had already suspected and tested—which is normally reversed biased by this negative voltage. Its job is to conduct during the retrace period and clamp its associated grid, and the grid side of the coupling capacitor, to chassis.



A simplified drawing of the relevant portion of the circuit, ie, the colour difference amplifiers and DC restoration circuitry. While a faulty coupling capacitor from the B-Y amplifier was suspected, it was not the cause.

Having digested all that—and it is rather easier to visualise mentally than it is to describe on paper—I tried to consider possible causes of the present fault. One thing that the study seemed to indicate was that the fault could be a failure of either part of the clamping circuit or a failure in the signal path whereby no video was being applied to the blue gun.

On the face of it I was inclined to favour the latter theory. The main part of the clamping circuit, that portion common to all three guns, was apparently functioning correctly, since two of the guns were working correctly. That left only the 10M resistor, R321, and parallel diode, of which the latter had been checked.

And, while I didn't discount the 10M resistor, I couldn't think of a likely fault which would fit the symptoms. The most likely failure, "open circuit" or "high" would hardly fit, and it would be unusual for a 10M resistor to decrease in value.

On the other hand, failure of the coupling capacitor (C320) could cut off the video signal, and this seemed a much more likely possibility. Either that, or I would have to start back tracking with a CRO through the transistor and drive circuits.

So first thing the following morning I tried replacing C320, as much as anything because it was a relatively simple operation. Unfortunately for my ego, this made absolutely no difference.

This brought me back to considering the 10M and, with it, the parallel diode. For the truth was, I now realised that my testing of the diode had been somewhat cursory. I had simply looked quickly at the resistance in both directions, using one of the medium resistance ranges on the multimeter. When one direction showed "open" and the other "short"—or approximately so—I had assumed all was well.

Now I decided to look a bit closer. Using the highest ohms range I had available, I measured all three parallel combinations. Those for the red and green guns gave similar readings; about eight megohms, suggesting a diode reverse leakage of about 40 megohms.

But the blue gun combination read only about four megohms, suggesting either a leaky diode or a 10M resistor which had dropped its bundle.

Lfting one end of the diode allowed me to check the resistor, which was quite OK. So I replaced the diode, whereupon all the voltages dropped back into place, the blue gun came good, and the yellow cast disapeared.

Subsequent measurements showed that the reverse leakage of the diode was closer to seven megohms than the 40 megohms suggested for its companions; a pretty crook figure for any diode.

Even so, I was somewhat surprised that its effect on the circuit was as drastic as it was. Apparently, the lowered resistance robbed the blue grid of a significant amount of blue signal; enough to upset the colour balance and show up as a pronounced negative bias.

As usual, there was something to be learned from the story. On the positive side there is what one can learn by observing the picture carefully. On the negative side there is the sharp lesson that "cursory" measurements can be worse than useless. Not only do they not help; they actually hinder, by prompting misleading conclusions.

By way of explanation (rather than excuse) I can only say that I was looking for a straightout "open" or "short", rather than any subtle degree of leakage. I'll know better next time.

And here is a small general interest snippet to finish off. Browsing through the Japanese electronics industry journal, "JEI" I came across an advertisement obviously intended for the executive who has everything.

It is called the "Carry-phone" and operates from a base unit which plugs into the telephone outlet and the power point. This contains an FM (repeat FM!) transmitter operating in the region of 1.7MHz and a receiver (FM again) in the 27MHz region.

The telephone proper looks like an ordinary modern handset, complete with dial, except that it is fitted with a telescopic aerial. It contains complementary FM transmitters and receivers and can be used up to 100 metres from the base.

As the ad says, "You can take it anywhere!" (Even into the tiled office?)

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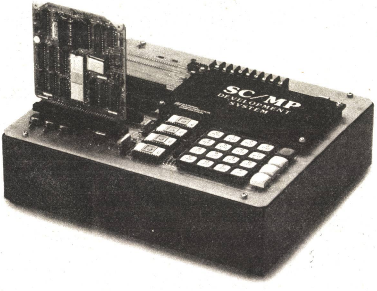

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Conducted by Ian Pogson

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Automatic battery charger

A design for an automatic battery charger was recently submitted to these notes by Mr K. Buckley of 13 Animbo St, Miranda, 2228. Mr Buckley's version of the charger was somewhat specialised, in that it was designed for a heavy duty 24V battery, used in the starter circuit of a 500kVA emergency lighting plant in an industrial installation.

However, the design philosophy behind the circuit may be of interest to those reades who would like to experiment. It was taken from an application note (No. 200.33) issued by the General Electric Co (USA) and supplied to Mr Buckley by their Australian subsidiary, Australian General Electric Ltd, 86 Bay St, Ultimo, 2007.

The circuit shown is one of several basic circuits given in the application note and a simplified explanation of its operation is as follows: The silicon controlled rectifier SCR1 functions as a half wave rectifier to charge the battery, being gated on via R1 and CR1 while ever SCR2 is not gated on.

SCR2 will not be gated on until the voltage at the moving arm of pot R3 exceeds that of the zener diode (CR7) breakdown voltage. When SCR2 fires it pulls the gate of SCR1 towards the negative rail, SCR1 cannot fire, and charging ceases.

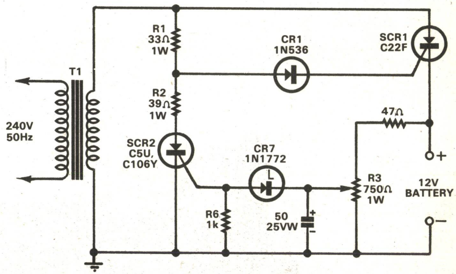
The resistor network across the battery, including the pot R3, senses the rising battery voltage as the charge progresses. The moving arm of R3 is adjusted to fire SCR2 when the battery voltage indicates full charge.

There are some points to be noted about the basic circuit. Since the system depends on a rising battery voltage to indicate the charge condition, the charge should approximate a constant current law. This may be provided by keeping the source impedance high, either by adding resistance in series with the transformer secondary, or by using a special transformer having a high leakage reactance.

(Ferguson Transformers designed and built a suitable transformer for Mr Buckley.)

The basic circuit may be modified, with advantage, to make it a full wave rectifier system. To do this some form of full wave rectifier–bridge, centre tapped transformer etc–is introduced ahead of SCR1, enabling the latter to conduct on both half cycles of the AC.

A trickle charge facility, to take over when the main charging circuits cuts out, can be fitted quite simply. An additional diode, in series with a relatively high value resistor, is connected effectively in parallel with SCR1.

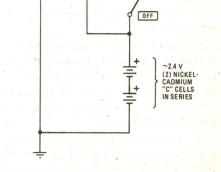


Battery backup protects memory

Using diodes to isolate a backup battery from the power supply of microprocessor memories works fine, if the 0.7 to 1.0V drop across each diode can be tolerated. A more efficient method substitutes saturatable switching transistors that have a drop of less than 100mV, which minimises current drain and therefore extends battery life.

Moreover, the voltage of the nickel cadmium battery supply need only be 2.4V, since during a power failure a standard transistor delivers all of 2.3V to the memories. That is more than enough for such metal-oxide-semiconductor devices as the 2102 static random-access memory, which only begins to lose data if its supply drops below about 2V.

The circuit shown is connected between the +5V supply line and the supply input of the memories. When the 5V supply is functioning normally, transistor Q1 is biased heavily into conduction by the difference between the supply voltage and that of the batteries. The voltage delivered to the memories is then about 4.9V, since the drop across Q1 is at most 100mV. During this time, the R1, R2 voltage divider holds Q2 off, and the bat-



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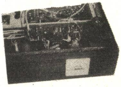

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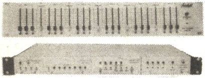

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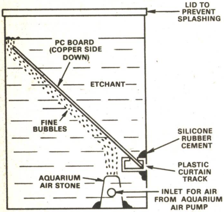
teries receive a charge of about 20mA through R3 and the base-emitter junction of Q1.

When power failure occurs and the 5V supply drops below about 3.1V (which is 2.4V + Vbe), Q1 begins to cut off, isolating the dying 5V supply from the load. At the same time, Q2, biased by the R1, R2 voltage divider, begins to conduct, connecting the backup batteries to the load. The reverse bias on transistor Q1 prevents the batteries from discharging through the supply circuit.

Both Q1 and Q2 were chosen for their very low saturation characteristics. Although their current ratings seem far in excess of what is needed, the result is that they exhibit a Vce(sat) of less than 100mV. But any PNP power transistors of the same general qualifications as those specified should suffice. The standby switch has been included to permit defeating of the battery backup feature. (By Raymond N. Bennett, in "Electronics".)

Idea for etching PC boards



After damaging a number of PC boards by poking around in murky ferric chloride solutions with various sharp objects, trying to find out how the etching process was coming along, it occurred to me that there must be a better way to do it.

Pumping the solution over the board seemed to be impractical for a number of reasons, including cost and complexity. I ended up with the idea of replacing the water in the family fish bowl with ferric chloride or other suitable etchant and providing a means of supporting the board to be etched, copper side down, at about a 45° angle in the sheet of bubbles rising from the air stone.

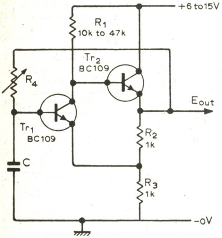
The bubbles rising across the board constantly wash away the by-products of the etching process and at the same time move fresh etchant up from the bottom of the container. Gravity holds the board in the proper attitude and I normally attach a slighty modified spring type clothes peg to the top of the board, so that the board may be lifted out now and then to see how things are going.

I actually used a tall square sided plastic food container, with lid, which I obtained from Myers for 89 cents. An air pump cost $6.90, tubing 15 cents, and air stone 50 cents, and a piece of plastic curtain track came from my junk box. The curtain track comes in a number of configurations which contain the required T shaped channel and may be used as is, or the unused bits may be cut off.

As may be seen, if the family fish will allow one to borrow their air pump at intervals, the cost is very reasonable. I would not suggest borrowing their air stone though, as the residual etchant in the stone might etch away their fins or do something equally nasty!

(By Mr F. Halliwell, 10 Nidella Street, Macgregor, Qld 4109.)

Square wave generator



When the circuit shown is switched on C is uncharged and Tr1 is non-conducting. Transistor Tr2 is therefore fully on and its emitter is at a potential near Vcc. Capacitor C therefore charges until Tr1 begins to conduct, which causes Tr2 to cut-off rapidly, by regenerative action. The emitter of Tr2 falls to a level determined by the ratio of R1 to R3, and C discharges through R4 until Tr1 cuts off and the cycle repeats.

The transition times of the circuit are rapid and it will work with small-signal silicon transistors up to at least 0.5MHz, and down to a frequency determined by CR. The output is almost an equal mark-to-space ratio over a wide frequency range, though this can be trimmed if required by the ratio of R2 to R3, or by a small resistor in Tr1 Base.

(By J. L. Linsley Hood, in "Wireless World".)

BASIC ELECTRONICS

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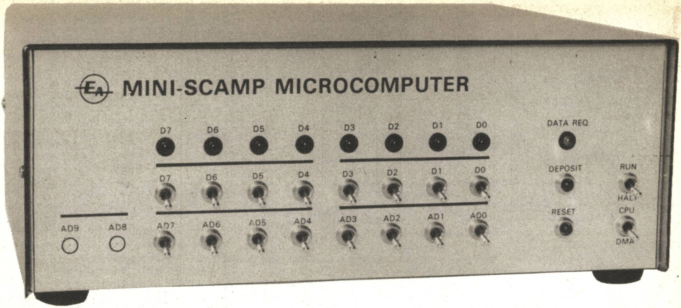


Look what happened to the Mini Scamp!

With some help from component suppliers, we have been able to turn Dr. Kennewell's Mini Scamp microcomputer design into a complete full-scale construction project. With almost all of the circuitry on a single PC board, it is now not just the lowest-cost complete microcomputer system available, but the easiest to build as well!

by JAMIESON ROWE

Just about everyone interested in microcomputers seems to agree that Dr. John Kennewell's Mini Scamp design has great potential. By starting from scratch with a SC/MP chip, and then designing a simple RAM-orientated system around it, he has produced an ideal microcomputer for the hobbyist and student.

It is fully self-contained, needing no expensive terminal. Programs are fed in via front-panel switches and LEDs, which can also be used to communicate with the machine when it is running—in simple binary code, the actual language used by the machine itself. What better way to learn how computers work!

At the same time, it can be built for around half the cost of any other microprocessor based system, and hundreds of dollars less than broadly comparable earlier designs like our own EDUC-8.

In other words, it is a design which should appeal to a wide variety of people, especially those still looking for a way of becoming familiar with microcomputers easily and at low cost.

While we were preparing Dr. Kennewell's article for last month's issue, the conviction grew that the project deserved to become a very popular one. But we realised that one thing was lacking: a low-cost PC board, to make it really easy to build even tor those with little previous experience.

We immediately resolved to design a PCB for the project, to help ensure that it wins the popularity it deserves. And we managed to fit a small "stop press" box in the April article, to let readers know that a PCB was on the way.

Because of the box no doubt quite a few readers have been waiting for the current issue, for the promised PCB design. As you can see, we have in fact gone much further than this, and have turned Mini Scamp into a full-scale project. So that your wait should not have been in vain.

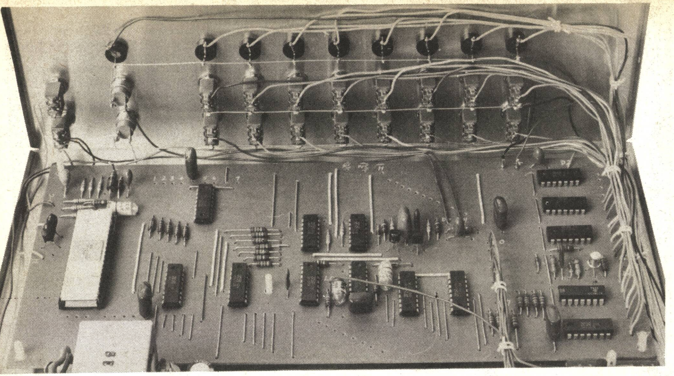
How did this happen? Well, we couldn't publish the PCB design without trying it out first, to make sure it worked. This meant getting together a set of ICs, switches and other components, and at the same time warning suppliers that the project was coming—to ensure that readers would be able to buy the parts. While we were doing this we sought reactions from suppliers also, to see if they became as keen about the project as we were.

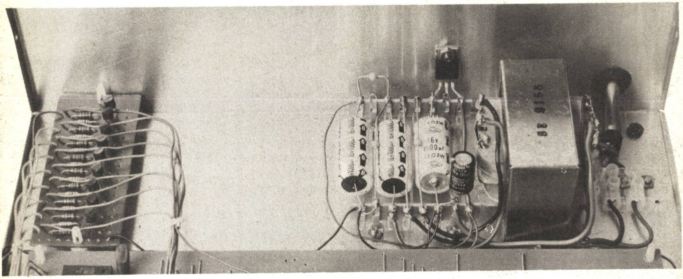
They certainly did. In fact, some of the suppliers were so enthusiastic that they offered to make some of the components available to readers at special prices.

For example NS Electronics have offered to make available through their distributors a special deal on the SC/MP chip, all the other ICs, the transistors and LEDs. These will be available for $36.21 including tax, or $31.49 to schools and colleges who can claim a tax exemption, until the end of June.

Similarly C&K Electronics are prepared to supply the complete set of 18 toggle switches and 2 pushbuttons direct to readers for a package-deal price of $14.65 plus 50c postage, or $12.74 plus 50c postage for those who can claim a tax exemption. Their address is PO Box 101, Merrylands, NSW 2160.

When we told the story to well known kits-n-bits entrepreneur Dick Smith, his immediate question was why we weren't





As these pictures show, Mini Scamp now really looks the part, comparing well with machines costing much more. You should be able to build it for around $105 including tax, and thanks to the new PC board it should take you only a few evenings' work!

planning to describe such an excellent design as a full-scale construction project. This would then allow his firm and, others to produce a complete kit . . .

Needless to say, we decided there and then to do just that. And thanks to quite a bit of help from Dick Smith, NS Electronics, C&K, RCS Radio, Radio Despatch Service and Bespoke Metalwork, we have been able to produce the full project in double-quick time.

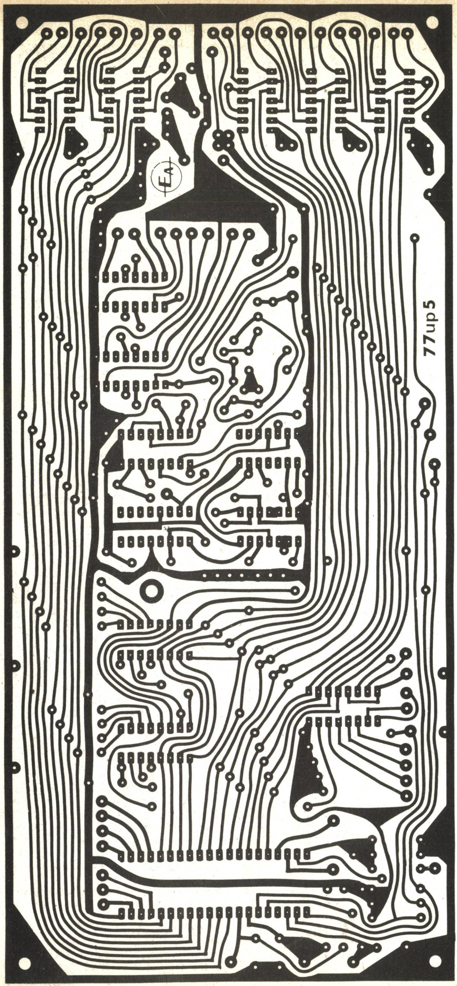
As you can see, it really looks the part, comparing very favourably with designs costing three and four times the price. Yet with most of the circuit on a single PCB measuring 254 x 117mm, you should be able to wire it up very easily in a few evenings.

The basic design has 256 bytes of RAM memory, plenty to let you cut your teeth on basic programming. However we have provided the PCB with data bus, address bus and control signal access, so that additional "outboard" memory may be added very easily. In fact all you will need to expand the memory to 1k bytes is six more 2112 memory chips, a small PCB or piece of perf-board to mount them on, and some hookup wire!

We have even allowed for a couple of additional address switches to be mounted on the front panel, if you want to expand the memory to 1k in this way.

We have also brought out all of the flag and sense pins on the SC/MP chip itself, so that it should be possible to interface Mini Scamp to a terminal later on if you wish. If there is sufficient reader interest we may be able to tell you how to add the "Kitbug" ROM into the system, with its terminal interfacing and debug routines. This should again be a relatively simple matter.

Wiring up the PCB should be quite straightforward as we have prepared an overlay diagram showing the position and orientation of all parts. There is a reasonable number of links, as the PCB is single-sided to keep the cost low, but not so many as one might have expected.



PARTS LIST FOR OUR MINI SCAMP

1 Case, 285 x 235 x 104mm
1 Printed circuit board, 254 x 117mm, coded 77up5
18 SPDT miniature toggle switches, C & K type 7101 or similar
2 Miniature pushbuttons, single pole normally open type, C & K type 8532 or similar
1 stepdown transformer, with multi-tapped 15V secondary at 1A. Type 2155 or similar

SEMICONDUCTORS

1 ISP-8A/500D microprocessor (SC/MP)
2 2112 memory chips (256 x 4)
2 74C175 quad latches
1 74C10 triple 3-input gate
1 74LS138 decoder
1 74LS05 hex inverter
5 7401 hex inverters
1 7476 dual flipflop
1 74123 dual monostable
12 BC108, BC317 or similar transistors
9 5mm diameter LEDs with panel adapters (8 red, 1 green or yellow)
1 LM340T-5, 7805 or similar 5V/1A 3-terminal regulator
4 1N914, 1N4148 or similar diodes
4 50V/1A rectifier diodes
1 6.8V/1W zener diode

RESISTORS

1W rating: 1 x 56 ohm
¼W rating: 9 x 150 ohm, 1 x 390 ohm, 1 x 470 ohm, 1 x 2.7k, 2 x 4.7k, 2 x 6.8k, 1 x 8.2k, 19 x 10k, 2 x 18k, 20 x 27k, 2 x 100k

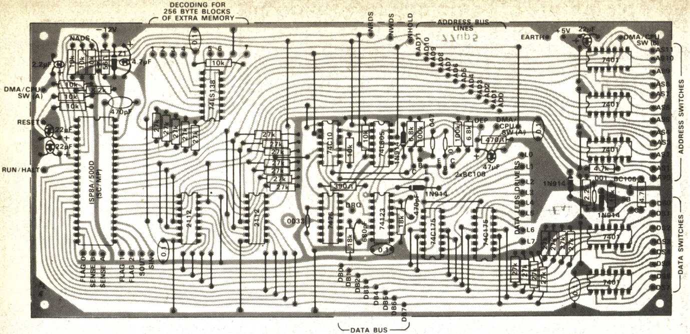
CAPACITORS

LV greencap polycarbonate: 1 x 1000pF, 1 x 3300pF, 1 x .01uF, 1 x .047uF, 5 x 0.1uF
2 470pF polystyrene or NPO ceramic
1 680pF polystyrene or ceramic
1 2.2uF 35VW tantalum
1 4.7uF 35VW tantalum
3 22uF 6VW tantalum
1 47uF 6VW tantalum
1 100uF 16VW electrolytic
3 1000uF 16VW electrolytic

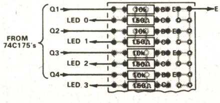
MISCELLANEOUS

Three-wire mains cord and 3-pin plug; grommet and cord clamp; 40-pin DIP socket for SC/MP (PC type); 7 x nylon PCB supports (Richco); 1 x 85 x 40mm piece of utility PCB for LED drivers; 2 x 8-lug miniature tagstrips for power supply wiring; 4 rubber feet for case; connecting wire, solder, nuts, bolts, etc.

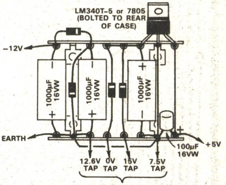
At left is the PCB pattern reproduced actual size. Etched and drilled boards should be available from the usual suppliers by the time you read this.



Wiring up the PCB should be fairly straightforward using the above diagram as a guide. Note that the address and data bus lines are brought out only for future expansion; this applies also to the flag and sense lines. Details of the LED driver and power supply wiring are shown below and at right.



HOW TO WIRE THE LED DRIVER PANEL (9 DRIVERS IN ALL)



2155 TYPE TRANSFORMER POWER SUPPLY WIRING

Incidentally the PCB hole spacing for the SC/MP clock capacitor is 12.5mm, so that readers who wish to substitute a 1MHz quartz crystal for the existing 470pF capacitor can do so easily. This would perhaps be advisable when and if you wish to interface the Mini Scamp to a terminal, to ensure a stable and predictable data rate.

Except for the SC/MP chip itself, all of the ICs are mounted directly on the PCB without sockets. A high-quality 40-pin socket was used for the SC/MP because of its higher unit cost.

We have not included the LED driver transistors and their associated resistors on the main PCB. This would have committed builders to using the binary LED scheme, and we think that some may prefer to use a pair of 7-segment displays with hexadecimal drivers instead. By leaving the drivers off the PCB, you can take your pick.

The original 9-LED scheme has been retained for our version of Mini Scamp, as you can see. This is because we think beginners find a simple binary display easier to follow. It will also be somewhat cheaper than a hex display!

We wired the 9 driver stages on a small piece of utility PCB, of the type having an array of 4 linked-pad groups. By cutting some of the conductors to form pairs, the drivers were very easily wired, as shown in the small diagram. The piece of utility PCB measures only 85 x 40mm.

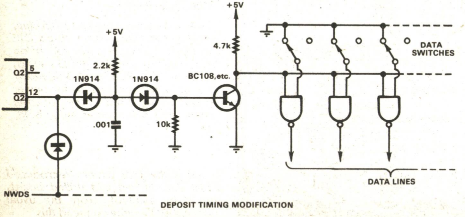
To reduce costs we elected to use one of the imported DSE 2155 transformers. As this provides only 7.5V per side on the secondary, we were unable to use the twin full-wave rectifier circuit suggested by Dr. Kennewell last month. The positive rectifier is unchanged, but we have substituted a half-wave doubler for the negative supply. This runs from the "12.6" tap (i.e., 5V with respect to the earthed centre-tap), to produce the desired −12V.

The only other change to the power supply is that we found it necessary to add a 100uF/16VW electro across the output of the 5V regulator. The wiring of the final supply is shown in a small diagram, so you can copy it if you wish.

One further point: you will find that the PCB incorporates a change to the memory deposit circuit. In particular, we have added an RC delay circuit and a buffer transistor to the drive line for the data switch gates, as shown in the diagram at left. Drive is now taken from the Q2-bar output of the 74123 (pin 12), instead of from the Q2 output.

We found this modification necessary to ensure fully reliable depositing with the 2112 memory devices, which have a critical requirement in respect to data hold time.

Well, there you have it. We think you'll agree that Mini Scamp has become quite an exciting project—and an excellent way to learn about microcomputers.



DEPOSIT TIMING MODIFICATION

The Motorola 6800

One of the most established microprocessors, the Motorola MC6800 is supported by a continuously expanding "family" of memory and specialised interfacing chips—and also by a great deal of proven software and applications experience. In this article we look at the MC6800, its main support chips, and also the recently released MEK6800D2 "Mark II" evaluation kit.

by JAMIESON ROWE

Motorola Semiconductor Products were only the second major US manufacturer to enter the microprocessor field, in 1974. The MC6800 was their initial entry, and the fact that it is still one of the market leaders—and showing no signs of giving ground—testifies to the soundness of the basic design concept. Needless to say it is now supported by a large amount of development and applications software, much of it generated by users. This inevitably increases its appeal for potential new users, compared with newer entries to the field.

It is strongly supported in another sense, too: along with the basic microprocessor chip there are a number of matching memory and interfacing chips, all designed to simplify system design. These include a 1024 x 8-bit ROM (MCM6830), a 128 x 8-bit RAM (MCM6810), a programmable 16-bit bidirectional Peripheral Interface Adaptor or "PIA" (MC6820), a programmable Asynchronous Communications Interface Adaptor or "ACIA" (MC6850), a programmable Synchronous Serial Data Adaptor or "SSDA" (MC6852), and a number of more specialised devices including some which are still in development. There are also various system housekeeping devices, including a family of hybrid clock oscillators.

As the block diagram suggests, the basic architecture of the MC6800 microprocessor chip itself is fairly straightforward. This is perhaps part of the secret of its success, although there are a number of subtle strengths which also emerge upon closer inspection.

There are only six internal working registers, one of which is a condition code or processor status register. Two of the remaining registers are 8-bit accumulators, both full primary accumulators of almost equal status. The other three registers are the program counter, an index register and a stack pointer, all three of which are 16 bits long. The MC6800 implements its stack in external RAM.

The status register has six active bits, one of which is the flag for enabling and disabling the master interrupt input. The remaining status bits are condition code flags, representing arithmetic carry and overflow, sign, zero and a bit-3 carry used for BCD arithmetic. None of the status register bits is accessible directly via external device pins.

Data and address information pass between the MC6800 and the rest of a system via two separate buses. One is an 8-bit bidirectional data bus; the other is a 16-bit address bus which gives the MC6800 the capability of directly addressing 65,536 or "65k" bytes of memory space.

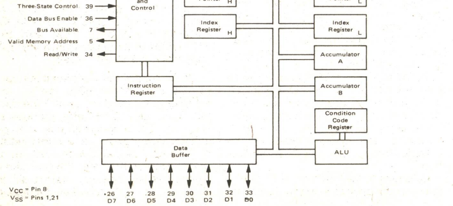
The output buffers on both the data and address lines are 3-state, and may be disabled for DMA operation.

There is no clock oscillator on the MC6800 chip itself. Instead there are two clock input pins, which must be fed with non-overlapping two-phase clock signals. Maximum clock frequency is 1MHz, and a machine cycle corresponds directly to a clock period. Fetching and execution of an instruction ranges from 2 to 12 machine cycles depending upon the instruction, or from 2 to 12us at the maximum clock rate.

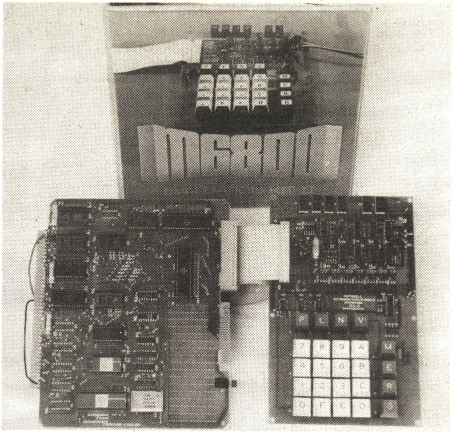
Incidentally the MC6800 is an N-channel depletion mode MOS device, made using silicon gate technology. As a result it operates from a single +5V supply.

Apart from the normal reset and master interrupt inputs the MC6800 is also provided with a non-maskable interrupt input. There is also a software-interrupt instruction, for program abortion. Vectoring is provided only for the different interrupt mechanisms; within each mechanism an interrupt source must be identified by polling.

What the MC6800 does do upon being interrupted is automatically save the contents of all its registers on the stack, in external RAM. This takes place in only 10 machine cycles, far less than would be required if the interrupt routine had to perform the saving by explicit instructions (required by most other micros).



Left: Basic architecture of the MC6800 microprocessor chip. Six registers are accessible to the programmer.



Here is the assembled MEK6800D2 evaluation kit. The two PCBs are shown in front of the binder containing hardware data and programming manuals.

The instruction set of the MC6800 comprises some 72 different instructions, ranging from one to three bytes in length. There are 29 instructions involving the accumulators and/or memory; 11 involving the pointer register and the stack pointer; 23 are jump, branch and special operation instructions; and the remainder are for status register manipulation.

The relatively large number of memory reference instructions helps to compensate for the relatively small number of working registers within the CPU chip itself. An interesting aspect of this is that many of the arithmetic and logic operations can be performed not only on the contents of the accumulators, as in other microprocessors, but on the contents of memory and interfacing chip registers as well. Thus the MC6800 lets you clear, form either the 1's or 2's complement, decrement, increment, rotate left or right, shift left or right, and test the contents of memory address and interface chip registers—as well as those of the accumulators—all with single instructions.

Apart from the inherent addressing used for instructions involving only accumulators and/or other internal registers, the MC6800 provides five different memory addressing modes. These are immediate addressing, direct or 1-byte absolute addressing, extended or 2-byte absolute addressing, relative addressing and indexed addressing.

Not all of these addressing modes are available for all instructions, however. In fact relative addressing is available only on branch instructions, and these instructions have no other mode available. Similarly the Jump and Jump-to-Subroutine instructions and many of the shift and rotate instructions have only indexed and extended addressing options.

With immediate addressing, the second byte of the instruction itself is interpreted as the operand data. With direct addressing the second byte is interpreted as an unsigned 8-bit absolute address, allowing addressing of the first 256 locations in memory space (00-FF hex inclusive). Extended addressing is similar to the latter except that the instruction has three bytes, and the second and third bytes are interpreted as an unsigned 16-bit absolute address, allowing addressing of any location in the 65k memory space.

In the relative addressing mode the processor interprets the second instruction byte as a signed 8-bit number, which is added to the current program counter contents to give the effective address. This allows addressing in the range from -128 to +127 bytes away from the location immediately after the second instruction byte.

In the indexed addressing mode the contents of the index register are used in generating the effective address, as with other microprocessors. However, in this case the second byte of the instruction is interpreted as an unsigned 8-bit number to be added to the index register contents, not a signed number as with the relative addressing mode. This means that the indexed address range only extends forward from the location specified by the index register, not backward; however, there is still a full 256-address range.

The large number of branch instructions provided by the MC6800 allow for considerable programming economy, particularly when data is being manipulated. Conditional branching conditions include carry clear, carry set, zero, greater or equal to zero, greater than zero, higher negative or zero, negative greater than zero, lower or same, minus, not equal to zero, overflow clear, overflow set, and plus.

Incidentally the MC6800 has no separate IOT instructions; all I/O devices are accessed as locations within the 65k memory space. As the MC6800 provides some fancy memory reference instructions, this can simplify programming for complex data communication applications.

Returning to the hardware side, one of the essential devices in any system using the MC6800 is a clock oscillator. As the microprocessor requires fairly critical non-overlapping two phase clock signals, Motorola provide a family of hybrid crystal clock modules in modified 24-pin DIL compatible packages. These are the MC6870 series, some of which provide just the basic two phase signals for the CPU together with a TTL signal for memory timing, while others provide a number of other signals as well.

There are quite a few memory devices provided by Motorola to support the MC6800, including both static and dynamic RAMs, mask-programmed ROMs, and an EPROM. Most of the devices are byte-organised and provided with multiple chip-select inputs to simplify system design, while both the MCM6810 128-byte RAM and the MCM6830 ROM operate from a single 5V supply like the MC6800 itself.

Of the specialised peripheral interfacing devices in the 6800 family, the MC6820 PIA is used for parallel interfacing. It provides 16 I/O pins, grouped in two sets of 8 although all pins may be individually programmed as either inputs or outputs. Associated with each set of 8 I/O pins within the PIA are three separate 8-bit registers, making six in all.

(continued overleaf)

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One in each group is a data buffer, another a latch whose bits specify whether the device pins are used as inputs or outputs; the third is a control register used to define interfacing protocol and status. All six PIA registers are addressable in MC6800 memory space, although in a slightly confusing manner: the control registers are addressed directly, while the data and direction registers share common addresses and must be distinguished by setting a control register bit.

The other peripheral interfacing device most likely to be found in smaller 6800 systems is the MC6850 ACIA, used for asynchronous serial interfacing. The ACIA is rather like a UART, having separate sections for asynchronous transmission and reception. However unlike a UART these share a common 8-bit parallel bidirectional interface to the 6800 system data bus. In addition, there is an 8-bit control register addressable separately in 6800 memory space, which allows program control of serial data format, a choice of three communication rate clock division ratios, and the handshaking protocol. There is also a status register, sharing the same address as the control register, whose bits may be read to determine ACIA status.

Having looked briefly at the MC6800 microprocessor, its instruction set and some of its support chips, let us now turn to the new MEK6800D2 evaluation kit. This has been produced by Motorola to provide a complete low-cost 6800 system, for both evaluation and basic program development.

The MEK6800D2 is an assemble-it yourself kit, which goes together to produce two PCB assemblies. One is the microcomputer itself, on a PCB measuring 248 x 210mm overall; the other is low-cost terminal unit on a PCB measuring 254 x 159mm.

The assembled microcomputer board has the MC6800 itself, a crystal clock module (614.4kHz), a 1k byte ROM with resident "JBUG" monitor program, three 128-byte RAMs (one of which is allocated to the monitor, leaving 256 bytes for user programs), two PIA devices and an ACIA.

The PCB also has decoding and sockets for easy expansion using a further two 128-byte RAMs, and two 1k byte EPROMs (MCM68708). It also has space for data bus and address bus buffers, if the user wishes to expand further into a multi-board system.

The assembled "terminal" PCB has a 24-key keyboard and a display using six 7-segment LEDs. Together these can be used with the JBUG monitor for entering programs, examining memory and registers, single stepping through a program, setting and removing breakpoints (five

```
SIMPLE DISPLAY PROGRAM FOR MOTOROLA MEK6800D2 KIT
WRITTEN BY J.ROWE, ELECTRONICS AUSTRALIA  9.3.1977

0000 CE 00 24   START,LDX DISBUF      SET X AS BUFF PTR
0003 DF 22            STX XBUF        & SAVE
0005 86 20            LDA A $20       SET PIA FOR DISPLAY U1
0007 B7 80 22         STA A DISREG
000A A6 00       LOOP,LDA A 0,X       FETCH CHAR VIA X
000C B7 80 20         STA A SEGREG    & DISPLAY
000F CE 00 4D         LDX $4D         SET UP X FOR 1MS DELAY
0012 BD E0 E0         JSR DLY1        CALL JBUG DELAY S-R
0015 7C 00 23         INC XBUF+1      INCREMENT SAVED BUFF PTR
0018 DE 22            LDX XBUF        & RESTORE TO X
001A 0C               CLC             CLEAR CARRY
001B 74 80 22         LSR DIGREG      UPDATE DIGIT PTR IN PIA
001E 24 EA            BCC LOOP        CONTINUE UNTIL 6 DONE
0020 20 DE            BRA START       BACK TO BEGIN AGAIN
0022 00 00       XBUF,                X IS STORED HERE
0024 02                               START OF MESSAGE BUFFER
0025 00
0026 40
0027 40
0028 21
0029 24
```

A simple novelty program for the MEK6800D2 kit. It displays encoded characters stored in locations 0024-0029 on the kit's 6-digit LED display.

are permitted), and transferring control to the user program.

In addition, the terminal PCB contains a full audio tape interface, to allow dumping and loading of programs using a normal cassette or reel-to-reel tape recorder. All that is required apart from the kit (and power supply) are a couple of shielded leads with suitable audio connectors.

The loading and dumping operations are controlled by further JBUG routines. Transfer takes place at a rate of 300 bauds, and the format conforms to the "Kansas City Standard" with 2400/1200Hz tones. The interfacing circuitry requires no "tweaking", using a stable counter-type decoder.

The terminal PCB connects to the main microcomputer PCB by means of a 50-way flat ribbon cable and edge connector. The keyboard and LED display interface via one of the two PIAs, while the tape interface uses the ACIA. The remaining PIA on the main PCB is available for user interfacing, with the terminal connected. If the user later decides to use the kit for a dedicated application, without the terminal PCB, all three interfacing chips can be used for interfacing.

It is also possible to convert the kit over for operation with a teleprinter or other serial asynchronous terminal. The main change required is to replace the JBUG ROM with another containing the terminal-orientated monitor "MINIbug III".

The complete MEK6800D2 kit operates from a single +5V power supply, drawing about 1 amp.

The Sydney office of Motorola Semiconductor sent us one of the MEK6800D2 kits, so that we would be able to assemble it and report to readers on our findings.

The kit comes in a single box, which opens to reveal one of the large spring-clip binders. Inside are two blister packs containing most of the parts for the two PCB modules, together with a plastic bag containing the rest of the parts. There are also a number of handbooks, including a kit manual, programming reference manual and M6800 system design book.

I found it fairly easy to put the kit together, although the instructions are rather cursory and assume that the builder has a fair amount of experience. Assembly took me about 7 hours, but I wasn't trying to break any records.

The kit worked perfectly when power was applied, and I was then able to run through the introductory program load-run-debug example which Motorola have thoughtfully provided in the kit manual. This is well done, and should give a newcomer to microcomputer systems a good idea of the basic concepts of program manipulation via a monitor.

When it came to writing our own programs, the going wasn't quite as easy. The programming reference manual doesn't seem to me to be particularly well written, at least as far as the introductory material is concerned. For example the material describing the various 6800 addressing modes complicates the issue by talking quite a lot about assembly language syntax, so that a beginner could get very confused.

As I was not too familiar with the 6800, it took a while to sort out chip operation from assembler operation. One thing which helped was a look through the listing for the kit's J-BUG monitor program, which Motorola have thoughfully given in the manual.

Once the addressing modes were sorted out, I was able to begin writing a few short programs and try them out. A sample program is reproduced here, as readers may find it interesting. It was written as a little exercise to see how one can use the LED display under user program control.

The kit manual doesn't help a great deal in telling you how to display data, so I had to deduce the way of doing this from the terminal circuit diagram and the J-BUG listing. It turns out that the routines in J-BUG itself are not capable of being called by user programs, as they are not self-contained subroutines. However, in any case it is fairly easy to provide a routine in one's own program, as you can see. This is largely because the PIA does most of the work.

The comments in the right-hand column of the listing should give you a fair idea how the program works. Note that the display digit multiplexing is performed by loading a 1 into one data register of the PIA, labelled "DIGREG", and then shifting the 1 along using the LSR instruction (address 001B). Similarly the actual digits are fed to the display segments by loading them into the other PIA data register, labelled "SEGREG".

The only part of the J-BUG monitor made use of by this little program is the subroutine DLY1, used to obtain the 1ms delay between displayed digits. This is used by first loading the index register with hex 4D, to specify a 1ms delay time, and then calling the subroutine at address E0E0. The two instructions involved are those with their first bytes stored in addresses 000F and 0012.

Note that the simple 6-character message displayed by this program is stored in locations 0024-0029. They are not in ASCII code, but in a code whose first 7 bits correspond to the seven display segments, in complement form. Any characters capable of being displayed on 7-segment LEDs can be shown, by working out the appropriate codes.

To summarise, the MEK6800D2 kit seems a well-designed one, and should enable those with reasonable experience at electronic kit building to build up a low-cost 6800 system. When assembled it becomes a small but businesslike development system, adequate for learning 6800 programming and working up quite respectable programs. And with plenty of provision for expansion, you can make it grow into a more elaborate system when this is needed.

In short, good value for money at the quoted price of around $240. The kit should be available from Motorola distributors, in every state.

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BALL SPEED: The ball has 3 user presettable speeds; slow, medium and fast. A further control, (speed increment) can be set to increase the speed when four player hits (total by both players) have occurred. The speed will then move on to the next higher speed to that previously set by the user i. e. Low speed hits then 4 medium speed hits then 4 fast speed hits. These speed up features can be inhibited to enable any particular speed to remain constantly set. At the end of each point the ball reverts to the original set speed and the speed incrementer will operate again on the next point.

This feature was designed to give more skill to the game in that, as players become more adept at hitting the ball, the ball speed increases making it more difficult to hit.

SERVING: Serving can be manual or automatic. When in auto mode the ball will serve into play a minimum of 3 seconds after the last point was won. On manual serve the ball will serve immediately that serve conditions are met following the deression of a manual serve push button. The position of serve is random since the ball is always bouncing around even when not visible. The serve is indicated by the bat of the serving player flashing on and off at approx. 1Hz.

ANGLE CONTROL: The players 'bat' is split electrically into 3 disinct portions (top, middle and buttom) and these are used to control the angle at which the is reflected from the bat. In football where multi-hits are allowed a player may follow the ball to deflect its movement.

SCORING: Scoring is indicated by a two digit score displayed in the relevant players colors in the upper half of the screen,- left score red, right score blue. The score is displayed only during the time that the ball is out of play, and leading zeros are always blanked.

THE GAMES

TENNIS: The game is designed to simulate playing methods and rules of table tennis as closely as possible.The display consists of a rectangular court with dotted centreline in white on a background of green. The left player is red and the right player is blue. Each player has vertical and horizontal movement (Joy-Stick-Control) within the confines of his own half of the court the bat being blanked out on entering the opponets half of the court. The game is started by resetting the score which sets initial conditions and gives the first serve to the left hand player. The serve will then alternate every 5 points. To win the game 21 points must be reached with a clear margin of 2 points. If 20-20 is reached then the deuce circuitry operates. This causes the serve to alternate every point instead of every 5 points. The winner will be the first player to gain a 2 point advantage. The game also contains double hit protection in that if a player does hit the ball a second time before his opponent hits it loses a point by default. A double hit is also registered when the ball is served (from the relevant baseline) and the player whose serve it hits the ball before his opponent. This feature is included to prevent a player from staying near the baseline for serves. It means he must move away and get back quickly for the serve return which at fast speeds makes the game more interesting and skilful.

FOOTBALL: This game is designed to simulate English football but could equally be called hockey. This display consists of a rectangular court as in tennis but the left and right baselines are broken to create 'goal areas'. The court outline and centreline are again white. To provide a more realistic simulation of the game 'static defenders' are positioned in front of the goal areas, (approx. one third of goal area is covered by the defender) to act as a goalkeeper. The normal player 'bats' are free to move to any position on the court including the opponents half. The background is green and the static defender colors are red and white to match the normal player colors. To score points the ball must pass through the goal area. The ball will then serve from the losing players side but from the centre line. Since no points target are set in football or hockey the game is won by the number of goals scored in a given time. When reset score is pressed at the start of the game the first kick off is given to the left player and an internal timer is reset, which times out after 3 minutes. Double hit circuitry does not operate in football. This enables a player to 'dribble' and hit the ball as many times as required. This course will operate the speed incrementer and a player can quickly lose control by too many hits.

SQUASH: This game follows the rules and scoring methods of squash but could equally well be called handball. The display again consists of a white courtline with the right hand side totally white to simulate a 'wall'. The background is again green and the players red and blue. The ball in all games is white. Both players can move over the whole court area. The ball is served from the wall and left (red) has first serve on operation of the "reset score" control. To win a point a player must win on his own service be deflecting the ball past his opponent and contacting the left hand baseline. If a player wins a point on his opponents service then he only gains a service and not a point, this simulates the normal scoring precedure of squash. Double hits feature in squash, as follows:- When the ball comes off the wall either from a serve or in normal play then only one player is elegible to play the ball. i.e. if red last hit the ball or served, then blue is due to play. If red hits again then the blue is automatically awarded a point and the next serve.

Similarly, when a player has played the ball, if he plays again before the ball has contacted the 'wall' he loses a point and the serve. The player reaching 9 points is the winner if a margin of 2 points exists. If 8-8 is reached then deuce operates and the winner is the first player to gain a 2 point advantage.

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This month: audio power amplifier ICs

Op-Amps without tears—6

This month the author moves from low-power devices to those capable of delivering appreciable power. He discusses the general characteristics of these devices, and then describes typical devices of the low, medium and high power variety.

by J. BRIAN DANCE, M.SC

In the previous articles in this series we have discussed normal operational amplifiers, which can provide output currents of the order of 20mA. Such currents are too small to operate a loudspeaker at an appreciable volume.

It is possible to use the output from such a device to feed a pair of complementary power transistors operating as emitter followers in Class B. These amplify the current sufficiently to drive a loudspeaker. However, it is normally far more convenient to employ one of the special types of operational amplifier which contain internal transistors capable of handling much higher currents than those obtainable from ordinary operational amplifiers. Such power devices can drive a loudspeaker directly, or deliver power to another type of load. In many of these devices inverting and non-inverting inputs are available, as in an operational amplifier, but in other types of power amplifier only one of the inputs has an external connection.

POWER OUTPUT

The maximum output power which a device can deliver into a load is determined by the maximum voltage swing at the output of the device and the maximum current which the output can deliver to the load. These qualities are determined by the design of the output transistors inside the device, since there is a maximum voltage which can safely be applied to any transistor and a maximum current which can be allowed to flow through it.

Let us consider the case of a device which can provide output voltage swings of ±12V and a maximum current of 3A. Obviously the device must be operated from balanced positive and negative power supply lines in order to obtain the ±12V output swing, the voltage of each supply line being numerically a few volts greater than 12V (typically about ±16V); the extra few volts are required for the correct operation of the device and do not appear across the load.

The device under discussion will deliver the maximum current of 3A into a load impedance of 12/3 = 4 ohms. The peak power delivered will be 12 x 3 = 36W, but amplifiers are almost always rated on their "RMS" power output which is one half of the peak power, namely 18W in this case.

If such a device is connected across a load of impedance less than 4 ohms, the output current will tend to rise to a value above the maximum permissible 3A. In some devices this will cause damage; such damage may occur if the loudspeaker leads are accidentally shorted together when an input signal is applied. However most of the modern devices designed to deliver a moderate amount of power have an internal current limiting circuit, built onto the silicon chip, which prevents the output current rising above the maximum permissible value for the device concerned.

Power devices can be operated at less than their maximum permissible voltage, but the maximum power which can be obtained from the device will then be greatly reduced. The output of a typical device which can deliver 2W when operated from a 12V supply will fall to about 0.1W when the supply voltage falls to 4V. Some devices will not even operate correctly at supply voltages as low as 4V.

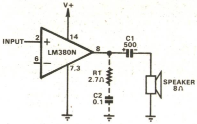

FIG. 39

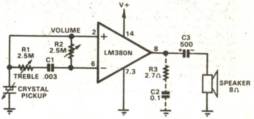

FIG. 40

Most power integrated circuits provide a fairly low output power (a maximum of a few watts) and are operated from a single power supply. However, the devices which can supply the maximum power yet obtainable from monolithic devices (about 20W) are usually operated from balanced positive and negative supplies. The quiescent output voltage is then zero, so that no output capacitor is required in series with the loudspeaker to prevent a steady current from flowing through the voice coil. Such a current would displace the coil from its normal position and would reduce the undistorted output power or prevent correct operation.

The mean output potential of devices operating from a single supply is about half the supply voltage with respect to ground. A large electrolytic capacitor must therefore be connected in the output circuit to prevent any steady current from flowing through the loudspeaker. The value of this capacitor must be large enough to enable the required bass response to be obtained.

It follows from our previous discussion that the maximum RMS power output from an amplifier is $V^2/2R$ where ±V is the maximum output voltage swing and R is the load impedance. When a single power supply is used, however, the output power is $V^2/8R$ where V is the peak-to-peak output voltage swing; V is a few volts less than the power supply voltage.

Monolithic audio amplifier devices are very easy to use provided one takes reasonable precautions to keep the input and output connections well separated to prevent feedback and possible oscillation. The use of such devices greatly simplifies the task of making an amplifier which will provide low to medium output levels. Audio amplifier devices are often the first type of integrated circuit used by a newcomer to electronics, and are ideal for the home constructor.

In general the writer would advise the inexperienced person NOT to employ a socket with any devices of moderate or high power output, especially if they are operated at a high gain, since the use of a socket can greatly increase stray capacitance and hence the probability of oscillation. In addition, the use of a socket with some types of integrated circuit audio amplifier can increase the thermal resistance to the surrounding air, and this results in the device operating at a higher temperature.

The devices available include very low power types providing a maximum audio output signal of a fraction of a watt, a

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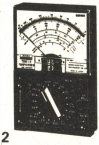
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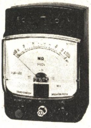
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7

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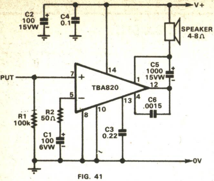

FIG. 41

number of economical devices with a maximum output of about 2W which are usually designed to operate from quite low supply voltages, quite a large number of medium power devices providing outputs of the order of 6W, and a few 20W devices which have recently become available.

A few of the characteristics of various modern power devices will now be discussed together with some typical circuits. In addition, we will consider a few devices which contain two separate audio amplifiers in a single package; these devices are very useful when one wishes to make a small stereo amplifier in which a single device provides power to both of the loudspeakers. Another type of device especially designed for television sound systems incorporates an audio power amplifier in the same package as a sound IF amplifier and a volume control circuit.

THE LM380N

The National Semiconductor LM380N can be employed in circuits with very few additional components, such as that shown in Fig. 39; it can deliver about 2.5W into an 8 ohm load when operated from an 18V supply.

The input to the Fig. 39 circuit is fed to the non-inverting input, but it can be taken to the inverting input instead. The capacitor C1 is the output blocking capacitor discussed previously; a somewhat smaller value may be used if a limited bass response is acceptable. The optional components R1 and C2 form a so-called "Zobel" network which may help to prevent possible instability at high frequencies (5-10MHz) when certain types of reactive load are used.

The quiescent current consumption of the LM380N is about 7mA. An internal current limiting circuit is incorporated into the device which limits the output current to 1.3A if, for example, the output leads are accidentally shorted. Another internal circuit switches off the power in the device when the temperature of the chip approaches the maximum safe value.

The voltage gain of the LM380N is fixed at 50 times (34dB) by the values of the internal resistors used. This enables the simplest possible external circuit to be employed, but renders the device somewhat less versatile than those devices in which the gain is determined by the values of external resistors. Internal frequency compensation is also incorporated onto the chip.

If the power supply capacitor is more than about 5cm from the device, a 0.1uF capacitor should be soldered directly across the power supply connections to the device to reduce the possibility of instability due to supply lead inductance. A capacitor of about 5uF connected between pin 1 and ground will provide about 38dB of rejection of ripple (that is, hum) on the power supply line.

An LM380N circuit for use with a crystal pick-up is shown in Fig. 40. As the value of the volume control R2 is reduced, the input signal is applied to both inputs and this common mode input signal produces less output. The control R2 and internal 150 kilohm resistor from pin 6 to ground act as a potential divider for the input signal. This type of circuit provides a much higher input impedance than the normal potential divider type of volume control. The treble control shown reduces the gain at high frequencies by allowing the high frequencies to pass through R1 and the small capacitor C1 to the inverting input where it effectively opposes the signal to the non-inverting input.

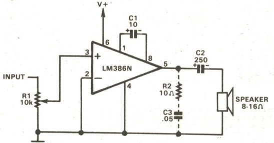

FIG. 42

More power can be obtained (about 5W) by using two LM380N devices in a bridge or push-pull circuit; the loudspeaker is connected between the two outputs and the input signal is fed to the non-inverting input of one of the devices and to the inverting input of the other device.

The LM380N is normally supplied as a 14 pin dual-in-line integrated circuit, but is also available in an 8 pin dual-in-line package with different connections from those shown in the circuits. The LM384 is a higher voltage version of the LM380N, the absolute maximum permissible voltage being 28V as opposed to the 22V of the LM380N. The LM384 can deliver at least 5W into an 8 ohm load at a total harmonic distortion of 10% using a 22V supply; a heat sink should be used. The ULN-2280 is a similar device to the LM380N, but is manufactured by Sprague.

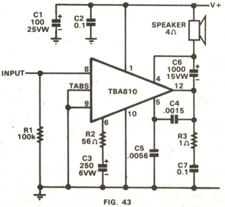

FIG. 43

LOW VOLTAGE DEVICES

The very economical TBA820 device from SGS-ATES has beeen designed so that it can be used with supplies as low as 3V, although the absolute maximum supply is 16V. It will deliver 2W into an 8 ohm load with a 12V supply or 1.2W into 8 ohms from a 9V supply. The quiescent current is 4mA, whilst the maximum permissible output current is 1.5A.

A typical TBA820 circuit is shown in Fig. 41. The gain is determined by the ratio of an internal 6 kilohm feedback resistor to the value of R2; the latter may be varied from about 10 to 120 ohms so as to vary the gain from 750 (55dB) to 50 (34dB). The gain is about 42dB with the value shown. The capacitor C6 provides frequency compensation and may be varied to obtain the required bandwidth, but the value required varies with the gain. For example, if R2 is 100 ohms and C6 is 200pF the bandwidth is about 20kHz, but is reduced to about 5kHz when C6 is increased to 1200pF. Similarly, if R2 is 50 ohms and C6 is 1800pF, the bandwidth is about 10kHz.

A capacitor of about 50uF connected between pin 2 and the positive line will provide about 42dB of ripple rejection if the power supply line is not well smoothed and will also tend to prevent the possibility of low frequency oscillation ('motorboating') in battery powered equipment when the internal resistance of the battery rises with age.

LM386N

The LM386N is another power amplifier designed to operate from low voltages, namely 4V to 15V, at a quiescent current of only 3mA. The gain is internally set to 20 (26dB) by internal resistor values, but an extra resistor and capacitor can be used to increase the gain up to any value up to 200 (46dB). In Fig. 42 this capacitor is used without any series resistor to obtain a gain of 200. The components R2 and C3 from the normal Zobel network.

The LM386N is supplied in an 8 pin

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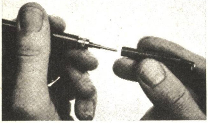

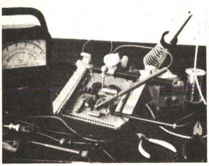

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dual-in-line package. It can provide an output of about 500mW at 10% total harmonic distortion into a 16 ohm load when fed from a 9V supply.

Economical devices with even lower rated outputs are available, such as the very cheap Motorola MFC4000B device designed to deliver 0.25W into 16 ohms with a 9V supply and the MC1306P 0.5W device.

MEDIUM POWER DEVICES

One of the best known medium power devices is the TBA810 which can deliver 7W into 4 ohms when fed from a 16V supply, or 6W into 4 ohms from a 14.4V supply. The maximum supply voltage is 20V and the maximum output current 2.5A. A thermal shut-down circuit is incorporated into this device to prevent damage from overheating and to reduce the size of the heat sink required.

The TBA810 has a quad-in-line configuration, but the centre pins on each side have been replaced by cooling fins. The TBA810S version has these fins bent downwards so that they can be soldered to the copper foil of a printed circuit board for cooling; this is known as the FINDIP package. The TBA810AS is similar, but has short fins with holes to which small heat sinks can be bolted.

A typical TBA810 circuit is shown in Fig. 43; it is rather like the TBA820 circuit of Fig. 41. The gain is about 80 with the value of R2 shown. C4 and C5 control the bandwidth, which is about 12kHz with the values shown. As in the case of the TBA820, it is essential to employ a resistor R1 between the input and ground or the device will not operate; the LM380N has an internal 150k resistor from the input to ground, so an external resistor is not usually required with this device.

The TCA830S is a device rather similar to the TBA810S in a FINDIP package, but the maximum output current is 2A. It can deliver 4.2W into a 4 ohm load when fed from a 14V supply. The TBA800 is another FINDIP device which can operate at a higher voltage (maximum 30V) but which can deliver only 1.5A. Thus it is used with higher impedance loads and can deliver 5W into 16 ohms using a 24V supply.

The TCA940 can provide 10W into 4 ohms using a 20V supply and incorporates both thermal overload and output current limiting circuits. This device has short tabs for the attachment of a heat sink, but the TCA940E is a similar device in a FINDIP package which can deliver 6.5W into 8 ohms from a 20V supply.

Another medium power device, the SN70008N from Texas Instruments, can deliver 10W into a 4 ohm load from a 20V supply. One of its most interesting features is the use of a flat plastic body with a hole for bolting a metal insert to a heat sink. Constructors not using a printed circuit board may find this type of encapsulation more convenient than dual-in-line packages.

20W DEVICES

The TDA2020 from SGS-Ates was the first monolithic power device capable of delivering 20W continuously into 4 ohms at 1% total harmonic distortion when fed from ±18V lines. It is supplied in a 14-pin quad or dual-in-line package with a copper insert for clamping to a heat sink. The TDA2010 is a lower voltage version of the TDA2020 with a 12W power rating.

Both thermal shut-down and output current limiting are incorporated into these devices. The current limiting circuits in these devices are most ingenious. The flow of current through a gold bonding wire (about 30 milliohm) produces a voltage drop which is used to monitor the output current and if the latter is high at the same time as the voltage across the output transistor is high, the base drive current is diverted from the output stage.

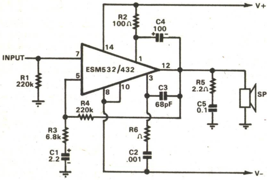

FIG. 44

Two rather similar 20W devices have recently been released by Thomson-CSF of France. The ESM532 is rated for a maximum supply of ±18V and the ESM432 for a maximum of ±15V. Both devices can deliver up to 3.5A and have current limiting and thermal overload circuits. They are encapsulated in 14 pin quad-in-line packages with a copper slug along the back for clamping to a heat sink. Similar devices with an 'N' suffix have a bracket fitted to the copper slug.

A typical circuit for the ESM532 or ESM432 is shown in Fig. 44 using balanced supply lines so that no output capacitor is required in series with the loudspeaker. The supply voltage may be ±15V or rather lower for the ESM432 to allow a margin of safety. The gain is approximately R4/R3, whilst C2 and C3 provide frequency compensation. The 'bootstrap' components R2 and C4 may be omitted if pin 1 is connected directly to the positive line, but the output power will then fall more quickly with the supply voltage on load.

The ESM432 and ESM532 devices can also be used for vertical sweep circuits in television receivers.

DUAL POWER DEVICES

The National Semiconductor LM377, LM378 and LM379 are dual power amplifiers intended mainly for stereo use. Their respective power outputs and maximum permissible operating voltages are shown in table 1.

The outputs shown in the last column are obtainable when the two amplifiers of one of these devices are operated as a single push-pull amplifier. The input signal is connected to the inverting input of one of the amplifiers and to the non-inverting input of the other, the loudspeaker being connected directly between the two outputs.

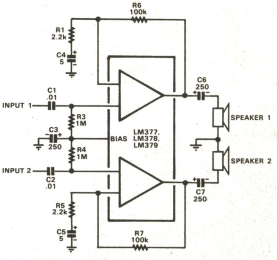

FIG. 45

A basic stereo amplifier circuit using one of these devices is shown in Fig. 45. Input capacitors must be employed so that a bias voltage can be applied through R3 and R4 to both inputs; this bias ensures that the mean output potential is kept at about half the supply voltage. The gain of each amplifier can be separately adjusted and is approximately equal to R6/R1 or R7/R5. The devices incorporate internal frequency compensation, thermal overload and current limiting circuitry.

The LM377 and LM378 are supplied in standard 14 pin dual-in-line package with especially wide spacing between the two rows of pins and a metal insert for bolting to an external heat sink. The electrical circuit of all of these types is similar, whilst the Sprague ULN-2274 is similar to the LM377 and the ULN-2278 similar to the LM378.

GENERAL CONCLUSIONS

The maximum power which can be obtained from a single monolithic audio amplifier device is at present about 20W, but work is being carried out on a higher power device for outputs of at least 50W and these should become available when the manufacturers are satisfied that there is an adequate market. Strangely enough the European manufacturers are well ahead of the US companies in power device development. The output from two 20W devices in a bridge circuit can reach about 36W, but higher power levels involve the use of either discrete or hybrid circuits. Output current limiting circuits are easily incorporated in all types of amplifier, but thermal protection is most readily applied to monolithic devices where all of the transistors are on the same chip. In discrete or hybrid circuits power transistors could be destroyed by heat before that heat raised the temperature of the sensing circuit which could limit the output current. On the other hand, the problems associated with thermal feedback (which can lead to distortion at low frequencies) cause problems to the power integrated circuit designer, but are not so vital in discrete or hybrid circuits.

Next month we will consider low noise audio pre-amplifier devices.

TABLE 1: POWER CAPABILITIES OF DUAL DEVICES

Type no.	Max. power per amplifier	Load (ohms)	Max. supply voltage	Max. power in bridge circuit
LM377	2W	8/16	26	4W
LM378	4W	8/16	35	8W
LM379	7W	8	35	13W

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Classical Recordings

Reviewed by Julian Russell

Richter: strange events on tour

CHOPIN—Polonaise in A flat; Studies in C Major and C Minor, Nos 1 and 12 from Opus 10.

DEBUSSY—Pagodas; Evening in Granada; Gardens under the Rain; Sails; The Wind in the Plain and the Hills of Anacapri. Svajoslav Richter (piano). Heliodor Stereo 2548 223.

All the items on this disc are taken from a 1963 two-disc issue, made live during Richter's Italian tour a year earlier. The events which occurred during this tour—and before it—are strange enough to bear repeating. I tracked them down to an article by Paul Moor in the April 1963 issue of the English Gramophone.

First, both HMV and DGG were anxious to record items during the tour. The genius of Richter had only become known to the Western world three years before and had received rapturous acclaim by critics and public alike. It seems that it was Richter who suggested that these two arch rivals should collaborate for this occasion and should jointly record his recitals and process their own tapes. After the two companies had got over their initial astonishment, they got together to work out technical and artistic details.

Now DGG had already had a vast experience in transporting stereo gear all over Eastern Europe, so the two companies decided that DGG should do the actual recording and both share the expenses of the project. Moor added that both companies spared no pains to do as good a job as they could. And that's where both companies' troubles begun. They learned from Richter that he admired a piano from Stockholm that he had once played in Finland. No sooner said than done. So at great expense the piano was hired for the whole tour with, in addition, a specially custom-built trailer to carry it in. But things didn't work out. Richter used the piano in Genoa, Turin and Milan, after which it became obvious that the instrument was a bad traveller and Richter refused to use it any more. So a search was made for another that pleased the meticulous Richter and this was finally run down, a 40-year-old American Steinway, in a Turin television studio.

But trouble followed trouble. To quote Moor's hilarious account: "The instrument's generous and canny owner refused payment for lending it for the rest of the tour but insisted his name be displayed in huge letters on the side of the piano facing the audience. Unfortunately, his name is the same as an Italian slang term for the human posterior, and in Florence the local manager flatly refused to let the audience in until the ribald embellishment was concealed from view." It then became necessary for a tuner of rival pianos to keep the instrument up to the mark during the ensuing weeks.

After finishing in one town Richter would travel by train to the next. DGG's bulky recording equipment had to find its own way by road through narrow Italian countrytown streets. On arrival DGG's engineer would use a single standing stereo mike on the stage between Richter and his audience, but in Perugia Richter played on the sixth floor of the Museum. Fortunately DGG had sufficient cable to reach down to street level.

There was more trouble in Milan when, in the middle of what was perhaps Richter's finest recital, the line went dead. In Bologna, during another superb performance, there was no van there to record it. It had been delayed with ignition trouble. On the way to Perugia the van copped a flat tyre with no spare. A village policeman, himself a music lover, repaired the puncture in time for the trailer to reach its destination without a moment to spare. Some of the transportation had to be made by water to Sicily and Venice. After the Venice concert the professional removalists didn't turn up and enthusiastic amateurs nearly had the piano in a canal. There were more troubles, too numerous to mention here, all described with sly humour by Paul Moor. It would be well worth the pains of running down this 1963 issue of the Gramophone just to be entertained by his article.

In view of all these hazards and catastrophes it is surprising that the end result turned out to be as good as it is. The items on the present disc under review are all taken from the one issued by DGG. HMV recorded Schumann and Scriabin pieces. Since all were recorded live there are many background audience participations, with the usual coughing and so on. But on the whole this reissue stands up well as a recording could under such overwhelming difficulties.

Of the Chopin group I liked best the Polonaise and the Ballade. The Studies are brilliant but for my taste a little heavy handed. On the reverse side the Debussy pieces are a delight, delicate yet firmly outlined, atmospheric and played with a bewildering variety of sonorities. I also found the Debussy side cleaner than the Chopin, which is far from free of "prickles".

★ ★ ★

ORFF—Der Mond. A musical piece that the composer describes as "a little world theatre". Most of the soloists' names would mean little to the average Australian but all are first class. With the Leipzig Radio Chorus and the Leipzig Radio Orchestra conducted by Herbert Kegel. Philips Stereo 6700 083. (Two discs).

Der Mond (The Moon) is a fairy story taken from Grimm which, according to the notes in the brochure accompanying the two-disc boxed set, has a meaning and a moral. But to appreciate what the writer, Karl Schumann, claims to be its three levels of action, you'll need a degree in philosophy! It is easier for the average listener just to take the work as a fairy tale without relation to our ordinary world, sane or insane, however you care to see it.

Orff's music has had a curious career. In the late 1930s his Carmina Burana was frantically acclaimed in most quarters as an elemental masterpiece. But after the first rapture died down, closer examination caused some critics to revise their opinion. They accused Orff of triviality in his constant use of ostinatos and short winded themes. But Carmina Burana has never completely disappeared from the musical scene. On the contrary, it is now receiving even more approval than it did when it was first played.

But most of Orff's other music has declined in popularity, if we exclude his production of a superb teaching method for children. But now interest has again started to revive and this new brilliant recording should fill a real need. Orff's style combines the strictly tonal with some excursions into polytonality and other contemporary techniques. Yet most of Der Mond should be, to most musically literate listeners, easily assimilable and enjoyable, much of it at first hearing. This is helped by the excellent quality of the engineering with its stereo perspective being especially spectacular. The score contrasts, as did Carmina Burana, exciting rhythmic patterns with long lyrical incidents. It has its goodly share of humour, too, much of it raffish. And all of its hammered rhythms, by their sheer hypnotic effect, make my old blood race. It may not be so the same for you. So be it.

The scoring is amazingly subtle, the

performance superlatively good. There is much talking, some of it whispered, some accompanied by the orchestra, some not. But most of it is sung, and splendidly sung, and played, too. There are some striking paramusical effects, one in particular—hedge clippers cutting the metallic moon into quarters—quite surprisingly realistic. The performers' superb diction enables those comparatively untutored in the German language to easily follow the vivid English translation. The faultless playing of the orchestra and the singing of the chorus is a supreme example of alertness and accuracy. The text contains much boozing and lechery, not uncommon in other Orff works. The constant changes of pace and vocal tone never allow the attention to wander for a moment. One final recommendation—get it!

* * *

BEETHOVEN—The Diabelli Variations. Daniel Barenboim (piano). Westminster Gold Stereo WGS8272.

Those who insist on orthodox tempos may well be surprised at some of the Tempos Barenboim uses here. I must admit that at times I found them a little disturbing. Perhaps he was trying to think of the whole work organically and not incident by incident as some other pianists do. His reading might be fancifully described as trying to give the work a plot. Well it just doesn't work, though many might think its enterprise quite valid. Of course this work demands a tremendous intellectual effort on the part of performer and listener alike. It is full of wondrous subtleties in its disguises of its somewhat banal theme and these can only be appreciated, and then hardly to the full even by constant examination. It can be made to sound a completely captivating or just another ultra long piano piece. And buyers are warned in the sleeve notes to stay away from it unless they are prepared to make this effort—surely an unusual bit of frankness to find on the back of any record sleeve.

Leaving out the vexed question of tempos, Barenboim plays for the most part interestingly and at times ravishingly. But however much one enjoys Barenboim's exquisite contrasting of sonorities, one has the discomfort of hearing No. 20, for instance, marked Andante taken at a speed more like Largo and the Vivace in No. 13 bustling along at something closer to a presto. Yet the performance is not to be dismissed in its entirety for this reason. There are long passages that compel the listener's enchantment though I think this was bound to happen with a pianist of Barenboim's unquestionable ability displaying his talents in a work that runs very closely to an hour in performance. It is one of those recordings which you will have to make up your own mind about—but don't forget the warning on the sleeve.

WOLF—Italienische Liederbuch. Elly Ameling (soprano); Gerard Souzay (baritone); and Danton Baldwin (piano). 46 songs to German texts by Paul Heyse. Philips Stereo 6700 041.

For the benefit of those readers of whom this group of 46 brief lieder are unfamiliar, I might explain that they are settings by Wolf of Tuscan folk poems translated into German by Paul Heyse. All are about that subject so dear to almost all German lieder writers—love. And a few are simply about sex, though the latter subject is never treated pornographically but rather describe what King Solomon found inexplicable on a famous occasion—the way of a man with a maid. Some of the songs obviously demand a male singer, others a female. Ameling and Souzay sing them alternately. However the notes in the accompanying brochure make things quite clear when they state: "The 'dramatic' sequence in which, on the one hand, the various ideas seem to rebound from one another, and in which, on the other hand, the assertions complement each other, should in no way create the illusion of a plot (there is none at all), but rather contribute towards the better presentation of the extraordinary diversity of the male and female characters portrayed in the lieder."

To say that both singers are completely successful in style would be an overstatement though lapses are very rare indeed. There is, however, one constant—the superbly played piano parts—they are much more than mere accompaniments—by Danton Baldwin.

It must be realised that in the space available here it is impossible to review individually and in detail two discs containing 46 different though related items. And to nickpit the rare blemishes would be to give an entirely wrong—and unfair—impression of the enterprise taken as a whole. The only comparable set, now, alas, deleted, was that recorded by Schwartzkopf, Fischer-Dieskau and Gerald Moore. In any case my preference is for this new issue, for though the earlier set—sung in a slightly different order—was bigger in concept, it lacked some of the sensitivity, and often the sparkle, too, of the performance under review. But here again I must utter a word of warning—it is necessary to get to know all the subtleties of the individual songs very well indeed in order to enjoy them to the full.

This is not a set of which one can easily tire. Rather it is one that repeated playings yield up more delights at every repetition. If you want to own a recording of the complete Italian Song Book this is the only one, so far as I could ascertain, available at present. And I doubt if a more attractive one is likely to be issued in the foreseeable future. Don't be put off if both singers seem to start a litte tentatively, even timidly. This is quite as it should be. The passion comes later. And the balance between piano and singers is never less than perfect. The texts are in English, French and German.

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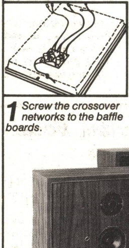

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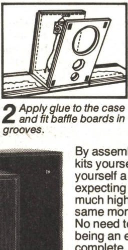

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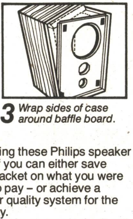
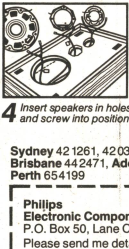
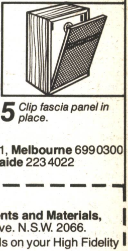


3 Wrap sides of case around baffle board.



4 Insert speakers in holes and screw into position.



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Lighter Side

Reviews of other recordings

Devotional Records

DAYSPRING. Choral Settings For the Contemporary Church. Sung by Dayspring. Stereo Word WST-8730. (From Sacred Productions Aust, 181 Clarence St, Sydney and other capitals).

As the title might suggest, this album contrasts in just about all respects with the Choir Of Winchester Cathedral, reviewed elsewhere. One is traditional, the other is modern; one uses a large organ and choir, the other a small intimate group with instrumental and rhythm backing; one was made in the reverberant space of a cathedral, the other in the controlled acoustics of a recording studio. Yet both are legitimately devotional and both communicate effectively to the generations they tend to represent. The titles: I Can't Wait – You Are The One – Clean Before The Lord – Holding On – Gospel Music – Jesus' Love Is A Potion – Welcome Back To Jesus – Got To Know You're There – I Don't Have To Worry – I Love The Way He Smiles At Me.

Dayspring, by the way, is a group of four young people, backed here by orchestra and close-up rock-style rhythm. They produce an easy harmony that will have an automatic appeal to the young (in heart?) without being too extreme for more conservative ears. And for those who may be interested, I gather that a book of the Dayspring arrangements would be available through the distributors.

The sound quality of the imported pressing is well up to standard. (W.N.W.)

★ ★ ★

SELAH. Stereo, Singcord ZLP 966S. (From S. John Bacon Publishing Co, 13 Windsor Ave, Mount Waverley, Vic 3149).

If ever an album is likely to convince a doubter that modern Gospel music has something to say, this would be it. The four young men who are responsible do a superb job: Steve Millikan–keyboard, vocals: Ray Moore–percussion; Rod Robison–lead vocals; Rick Swineford–bass guitar. Their message is clear, their diction is first rate and, for good measure the complete lyrics are set out in the double-fold jacket.

The titles: Jesus Paid It All – Leave It There – Just My Way – I'm Gonna Keep On Singin' – The Blood Will Never Lose Its Power – The Answer – Your Life – Searching, In The Sweet By And By, Oh Happy Day – He Is Alive – Selah (Think On These Things).

That last title, by the way, gives the clue to the motivation behind the whole album–a well chosen mix of mod. vocal and soft rock which will have strong appeal to the young and get through to the "mature".

From the Pinebrook Recording Studio, Alexandria, Indiana, USA, this imported album offers excellent quality as well as a top-line performance. Recommended. (W.N.W.)

★ ★ ★

THE CHOIR OF WINCHESTER CATHEDRAL, conducted by Martin Neary. Astor Golden Hour Stereo GH-629.

Astor have presented us with quite a variety of music on their "Golden Hour" albums, so why not 60 minutes of traditional cathedral music, complete with organ, a touch of orchestra, a couple of choirs and soloists? There are eleven tracks altogether:

Jerusalem (Parry) – Magnificat and Nunc Dimittis in G (Stanford) – Crimond (Grant) – Miserere, Psalm 51 (Allegri) – Be Near Me Lord When Dying (St Matthew's Passion) (J.S.Bach) – Chorale Prelude (My Heart Is Filled With Longing) (J.S.Bach) – Ascribe Unto The Lord (Wesley) – Hear My Prayer, O Lord (Wesley) – Fugue In E-Flat (St Anne) (J.S. Bach) – Beati Quorum Via Integra Est (Stanford) – God Be In My Head (Davies). Jacket notes comment briefly but helpfully on each item.

The music expresses very eloquently the atmosphere and the spaciousness of a traditional English cathedral and, if you are responsive to it, this album should amply repay its purchase price. Technically, the sound is of good average quality, natural rather than studied, but certainly with no vices to mar your enjoyment of the program. (W.N.W.)

★ ★ ★

SCRIPTURE SONGS, Liberty. Stereo, M7, MLX-040. ($4.98)

"Liberty" is introduced in the jacket notes as a group of young people who first got together in the Methodist Church in Liverpool, NSW. Now variously at University, theological college, nursing and elsewhere, they still find time to sing at Gospel rallies, etc. They are accompanied here by Garry Daley on piano, Cliff Danckwardt on organ, with production in the hands of none other than Sven Libaek.

The nineteen tracks on the two sides are mainly Scripture texts and themes set to music; hence the titles, and I quote just a few:

Cast Thy Burden – Father, We Thank You – Love Song – Philippians 4,8 – Glory, Jesus, Glory – Thank You Jesus – Father God – In Him Is Life – Bell Song – I Am With You, etc.

The occasional solo spots are average only but, as a group, Liberty produce a commendably smooth sound, set against effective instrumental accompaniment, ranging from gently swinging to soft rock.

Those with sharp ears may note a slight edge on the reproduction but, all told, the album must rate as pleasant, listenable Gospel by a local group. Playing time is a generous 46 minutes, approx. (W.N.W.)

Instrumental, Vocal and Humour

DIE FLEDERMAUS HIGHLIGHTS Vienna Philharmonic Orchestra Decca Set 600.

Die Fledermaus must be the best known of Johann Strauss's operettas and this record with some of Europe's best artists would be a useful addition to any collection of light classics. The Vienna Philharmonic Orchestra is conducted by Karl Bohm and the cast includes Eberhard Wachter, Gundula Janowitz, Renate Holm and Erich Kunz and the recording was made in 1971.

The sleeve notes give an interesting account of how the final operetta was derived from the work of a number of people, only the names of the characters being carried over from the original story idea by Karl Haffner. The overall quality is good, making for an enjoyable listening experience. (N.J.M.)

Reviews in this section are by Neville Williams (W.N.W.), Jamieson Rowe (J.R.), Leo Simpson (L.D.S.), Norman Marks (N.J.M.), David Edwards (D.W.E.) and Greg Swain (G.S.).

YOUR HUNDRED BEST TUNES. The New Chart. Vol 1. Stereo, Decca SPA-491.

If you feel that you've seen this record before, it's probably because you've come across one or more of the earlier series compiled by BBC broadcaster Ray Crick "The World Of Your Hundred Best Tunes"—"The Top Ten" or volumes 2 to 9. I guess that this would have been volume 10 if it had not been decided to change the title slightly and start all over again!

But the formula is the same: classical excerpts which have been voted as favourites by BBC listeners and, predictably, they're all strong on melodic appeal:

La Traviata, Prelude (Verdi) – Your Tiny Hand Is Frozen (Puccini) – The Serenade (Haydn) – The Fair Maid Of Perth (Bizet) – Piano Concerto No 21 (Mozart) – None But The Lonely Heart (Tchaikovsky) – The Crucifixion (Stainer) – Poet And Peasant Overture (Suppe) – The Barber Of Seville, Largo Al Factotum (Rossini) – Scheherazade (Rimsky Korsakov) –Panis Angelicus (Franck) – Lullaby (Brahms).

The jacket notes identify the items in full, the orchestras and soloists, and add brief background notes. And rest assured that these are not the also-ran performances from Decca's library. They are notable performances and , despite the varying age and background of the recordings, the sound is very good throughout—real Decca fare.

Provided you don't hold a prejudice against excerpts—and I don't—you should thoroughly enjoy this varied and tuneful hour-long program. Give yourself a treat. (W.N.W.)

★ ★ ★

MANTOVANI, AMERICAN ENCORES Decca SKLA 5234 EMI Release.

No doubt aimed at the American Bi-Centenary market, this record is a showcase of favourites with a strong American flavour, both old and new. Mantovani needs no introduction and the usual skilled performance of his orchestra gives us a dozen tracks: The Big Country – My Old Kentucky Home – Give My Regards To Broadway – Missouri Waltz – Folk Song Medley – Turkey In The Straw – Maria – Somewhere – The Yellow Rose Of Texas – Autumn In New York – By The Time I Get To Phoenix – Indian Summer – Stars And Stripes Forever.

The quality is up to Decca's usual high standard, making a very enjoyable record. The cover carries a good photo of the Mount Rushmore National Memorial. (N.J.M.)

★ ★ ★

CARIBBEAN CARNIVAL, Nite Blues Steel Band Astor Golden Hour GH 619.

If you enthuse over steel band music, this nineteen track release from Astor should make you very happy. Some of the titles are: Hot Blue Steel – Help Me Make It Through The Night – Bass Man – Everbody's Talking – Yellow Bird – Brazilian Love Song – Nobody's Business – Sweet n Breezy – Carmelita – Fiesta – Island In The Sun – My Special Prayer.

I have commented before how the fitting of a full half-hour on each side can lead to some sacrifice in quality but this disc does not seem to have suffered. (N.J.M.)

★ ★ ★

ALBEDO 0.39 VANGELIS RCA VPL 17118.

Whether one likes this record or not, it must be agreed that Vangelis exhibits a mastery of the synthesiser. He presents a series of tracks with an astronomical theme, the title referring to the albedo or reflectivity of the Earth's surface.

Use is also made of the PMG's talking clock and the recorded conversations of American astronauts during one of the Moon landings. The tracks, which vary in style from rock to Eastern to the almost symphonic, are: Pulstar – Freefall – Mare Tranquillitatis – Main Sequence – Alpha – Nuceogenisis – Albedo 0.39.

The quality is superb and the manner in which the stereo image has been exploited would make it an impressive 'demo' disc. (N.J.M.)

★ ★ ★

A COLLECTOR'S SHOW BOAT. Various aritists. Mono, Victrola America historic recordings. RCA AVM1-1741.

How historic is "historic"?

The detailed jacket notes tell how Showboat came to be written, the circumstances surrounding its early runs in Washington, Philadelphia, New York and London—and the songs which were displaced or added at various times. Perhaps that's one reason why the music reflects two distinct periods. Only three of the tracks date back to the Show's early days around 1928, with Paul Robeson and Helen Morgan. The remaining tracks are much more recent, dating from about 1949 to 1956, with Robert Merrill, Patrice Munsel, Janet Pavek, Howard Keel, Gogi Grant, Kevin Scott, Dorothy Kirsten and Rise Stevens. Between them, they present some fourteen songs from the show, plus opening choruses for Act I and Act II.

How you react to the album would depend on what you expect of it. As entertainment, dated performances on dated mono don't show up all that well. But if you're one of Victrola's target audience of "collectors", with a nostalgic interest in their featured artists then you can be assured that RCA engineers have done an acceptable job in blending recordings from the two time periods into a single album. (W.N.W.)

★ ★ ★

'LIVE' bullet. Bob Seger and the Silver Bullet Band. Capitol Records SIJ 11523. EMI release.

This double album was recorded live at Cobo Hall, Detroit, Michigan on the 4th and 5th of September, 1975. Judging by this album the crowd really got their money's worth. If you're into heavy rock, I can really recommend it, as it's superbly recorded.

The album gets off to a flying start with Tina Turner's "Nutbush City Limits", and the pace never lets up till the end of the last track. One track which I feel should be singled out above all the others, however, is "Turn The Page", a Bob Seger composition about life on the road.

In short, this album is well worth considering, particularly if you have an ear for a good recording. I could not fault my copy. (D.W.E.)

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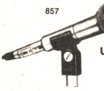

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SILENT MOVIE. Original Motion Picture Score United Artists L36028. Festival release.

Judging by some of the critics' comments, this is a movie well worth seeing. The sound track tends to bear this out, with a collage of most of the musical cliches used in sound tracks and themes over the years of movie making, complete with a great chase or two. The sound quality is good and the orchestra under the direction of John Morris does a good job of the seventeen tracks. Some of these are: Sidewalk Oddities—Engulf And Devour—Coat Routine—Marcel Marceau—Wheelchair Chase—Marty Feldman Twostep—Great Film Chase. The whole business sounds like a lot of fun. (N.J.M.)

★ ★ ★

THE TWO SIDES OF BARRY BAILEY. Electronic organ. Stereo, two-record set. Festival L-45607/8.

For this two-record set, Brisbane organist Barry Bailey has at his disposal a Rodgers "Marquee" 3-manual theatre organ—an impressive instrument styled in white and gold and reminiscent of the old-time theatre consoles.

In a program reflecting his divided interests—organ demonstrator, reception lounge soloist, and concert organist, he presents some twenty-one numbers on the two sides including, and I quote just a few:

The Entertainer — Spanish Eyes — More — Lara's Theme — Begin The Beguine — Jealousy — If I Were A Rich Man — Hungarian Dance No. 5 — Poem — Road To Mandalay — Stephanie Gavotte - I'll Walk Beside You — Roses Of Picardy — Colonel Bogey.

With such an insturment and such a program the music should really sing and swing but, somehow, isn't that kind of record. It has much more the sound of an organ evening in a private home or in a small, intimate reception lounge. Perhaps that's what it is, resulting in a somewhat congested and "Middley" reverberation, which is the antithesis of the spacious sound needed to do justice to a big organ. Popular organ buffs may be interested in the basic sounds of the Rodgers "Marquee" but Barry Bailey owes it to himself to seek out a more generous acoustic environment, and miking which will ensure a spacious, wide-range sound. (W.N.W.)

★ ★ ★

DAVID GRAY SINGS. With The Sven Libaek Orchestra. Stereo, M7, MLR-159.

If you've never heard of this record, it's a fairly safe bet that you watch commercial television less than most—such has been the promotion accorded to it.

Backed by the Sven Libaek Orchestra, David Gray sings a dozen popular evergreens: Roses Of Picardy—A Star Fell From Heaven—Trees—So Deep Is The Night—Be My Love—Ay! Ay! Ay!—Love's Last Word Is Spoken—Begin The Beguine—Song Of Songs—On The Road To Mandalay—Because You're Mine—When I Grow Too Old To Dream.

Recorded in the studios of Sydney's television Channel 7, the album offers very clear diction and a basically clean sound—with one reservation: David Gray's voice seems to trail a slight resonant edge which may have arisen from the studio acoustics or, more likely, from the addition of synthetic reverberation. But, while those with keen ears may notice the effect, it will certainly not disturb the many who will just want to sit

JASCHA HEIFETZ IN CONCERT. Brooks Smith, piano. CBS stereo S2BR 220341. 2-record set.

"There has probably never been a violinist who has more closely approached the summit of perfection more closely than Heifetz" is a quote from the sleeve notes of this album. While this statement could surely start an argument amongst musicologists they would all agree that Heifetz has been a remarkable virtuoso for over 55 years

The foregoing is all the more remarkable when listening to this two record set of Heifetz in concert. There is no impression that the violin player is in his seventies—rather a virtuoso at the peak of his prowess. And he is ably accompanied by Brooks Smith on piano.

Rather than go into detail I will state that this has been one of the most satisfying records to come my way for some time. Naturally, the recording standard is very high and surface noise was negligible.

The compositions featured are as follows. Franck: Sonata in A Major for Violin and Piano. Richard Strauss: Sonata in E-flat Major for Violin, Op 18. Bach: Prelude, Loure and Gigue from Partita in E Major, BWV 1006. Bloch: Nigun (improvision) from Baal Shem. Debussy: La Plus Que Lente. Rachmaninoff: Etude-Tableau No 7 in E-flat Major, Op 33 No 4. Falla: Nana (Berceuse) from Seven Popular Spanish Songs. Kreisler: La Chasse. Ravel: Tzigane (rapsodie de Concert). Castelnuovo-Tedesco: Sea Murmurs. (L.D.S.)

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CD4022	2.15	CD4539	1.98	LM375N	4.90	MC1458	LM1458	TCA580	6.50	S50242	15.00
CD4023	.55	CD4555	1.80	LM377N	3.50	MC1468L	6.50	TCA730	6.90	MA1002	13.50
CD4024	1.75	CD4556	1.80	LM379	7.50	MC1488	LM1488	TCA740	6.80	7805CP	2.90
CD4025	.55	CD4720	12.60							7824CP	

In some cases pin for pin substitutes will be supplied.

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7402	.48	7486	.85	82S23	6.95	74LS181	6.50	BF173	1.25	2N3638A	.60
7403	.48	7489	4.50	8281A	3.90	74LS191	4.50	BF180	1.20	2N3642	.55
7404	.48	7490	.90	82S90	7.50	74LS192	4.50	BF194	.85	2N3643	.55
7405	.48	7491	1.90	74LS00	.55	74LS193	4.50	BF200	1.30	2N3694	.65
7406	1.09	7492	1.20	74LS01	.55	74LS194	2.60	BFY50	1.20	2N3731	5.95
7407	1.09	7493	1.20	74LS02	.55	74LS195	2.60	BFY51	1.50	2N3819	1.35
7408	1.09	7494	2.20	74LS03	.55	74LS196	2.60	BPX25	4.90	2N3866	2.75
7409	.48	7495	1.65	74LS04	.65	74LS221	2.50	BSX19	.75	2N4037	1.25
7410	.48	7496	2.15	74LS08	.55	74LS253	2.75	BU126	3.85	2N4249	.65
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7414	2.70	74121	1.20	74LS11	.55	AC126	1.80	MJ2955	2.60	2N4356	.65
7416	1.00	74122	1.20	74LS13	1.20	AC127	1.80	MJ4502	8.90	2N4360	.95
7417	1.15	74123	1.40	74LS14	2.95	AC128	1.80	MPF102	.65	2N5245	.75
7420	.48	74132	1.90	74LS20	.55	AC132	1.50	MPF103	.85	2N5457	MPF103
7422	1.95	74141	2.75	74LS21	.55	AC187	1.50	MPF104	1.10	2N5458	MPF104
7425	.95	74145	2.95	74LS22		AC188	1.50	MPF105	.65	2N5459	MPF105
7426	.70	74150	3.25	74LS27	.60	AD149	2.60	MPF106	1.15	2N5485	MPF106
7427	.66	74151	2.20	74LS28	.60	AD161/62	4.50	MPF121	1.60	2N5590	MRF603
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7441	2.80	74165	2.90	74LS42	2.20	BC109	.35	TIP141	4.70	2SC1307	5.50
7442	2.60	74174	2.90	74LS73	.75	BC177	.40	TIP2955	1.70	BA102	.80
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7450	.48	74177	2.90	74LS90	1.95	BC327	.55	2N706A	1.20	40440	2N3731
7451	.48	74191	2.90	74LS92	1.95	BC337	.55	2N918	1.60	40637A	2.85
7453	.48	74192	2.75	74LS93	1.95	BC547	.55	2N2222A	1.20	40673	1.95
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7460	.48	74194	2.50	74LS109	.85	BC549C	.55	2N2869	2.70	40841	1.90
7470	.85	74195	1.90	74LS113	.85	BC559	.55	2N2904A	1.50	BZX61	.75
7472	.75	74196	2.90	74LS114	.85	BC639	1.20	2N2905	1.20	BZX79	42
7473	.80	74S00	1.50	74LS151	2.60	BC640	1.20	2N3053	1.20	BZX70	1.50
7474	.95	74S10	1.75	74LS153		BD131	1.20	2N3054	1.70	BZY93	2.60
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back and enjoy a recital of old evergreens, brightened up by Sven Libaek's backing and sung with good, old-fashioned diction and with every note spot on key! (W.N.W.)

★ ★ ★

JOHNNY CHESTER—INTO COUNTRY. Bullet Stereo BLT + 12-001. (Sound & Film Enterprise Aust Pty Ltd, 122 Chapel St, St Kilda 3182.)

Former Rock-n-Roll singer, Johnny Chester, has made a smooth transition to country music on this enjoyable album, backed by the Blue Denim Country Band. Fourteen tracks make up the list, some of these being: Cold Cold Heart — Country Bumpkin — Delta Dawn — Blanket — On The Ground — Take Me Home Country Roads — If You Love Me Let Me Know — Rose Marie — Before The Next Teardrop Falls — Back Home Again.

My only complaint is that Sound and Film Enterprises of Australia see fit to hide the catalogue number; I could only find it on the record. Records like this prove we have plenty of local talent to enjoy. (N.J.M.)

★ ★ ★

MOORE AND MOORE COUNTRY, Ray Moore Crest International CRT-12-SLP-933 (122 Chapel St, St Kilda 3182).

Country music is well looked after by Australian recording companies such as Sound and Film Enterprises of Australia, the producers of this excellent album. It features Ray Moore, who has been on the country music scene for twenty years.

Three of the songs were composed by Moore: Woman You're On Your Own — Goodbye My Love To You — What Good Is Loving. The other tracks are: Silver Wings — Come On Home And Sing The Blues To Daddy — Rhinestone Cowboy — Everybody's Talking At Me — Kentucky Woman — Hanging On — Mama Don't Cry For Me — Lover Come Back — For The Good Times.

Vocal backing is provided by The Cookies; all told a very enjoyable C&W album. (N.J.M.)

Amusing—or embarrassing?

HOUSEWIFE-SUPERSTAR. Barry Humphries. The Famous Charisma Label 9124 004. Distributed by Phonogram Pty Ltd.

Those who have seen Barry Humphries on stage will readily testify that he is a riot. So it was with anticipation that I began to listen to this album of edited recordings of his performances in the West End show, "Housewife Superstar".

The album opens with a portrayal of a character named Les Patterson who is the Australian cultural attache to the court of St. James. This went down reasonably well with the London West End audience but I suspect it would not be appreciated in Australia.

After that, Barry Humphries is on stronger ground in his characterisation of the devasting personality, Dame Edna Everage. Even so, he gains most of the laughs by taking the mickey out of various individuals in the audience including one unfortunate couple who arrived late. While this included some very funny sequences one cannot help feeling sorry for the hapless victims who may have been very embarrassed.

But the most uncomfortable moments for the listener and the audience was when Humphries treads on some delicate ground in his send-up of bathrooms. Here the audience as a whole was clearly embarrassed and responded only occasionally with a few isolated sniggers. Plainly, the subject was treated distastefully.

So potential buyers can be warned. While there is plenty to amuse on the album, your enjoyment may be tempered by feelings similar to those of the reviewer. (L.D.S.)

DANA, Lovesongs and Fairytales GTO 2321 116 Phonogram Release.

You might remember Dana as the young Irish girl who won the Eurovision Song contest a few years ago. The talent is very obviously still there, on this disc, as she sings ten songs with a gentle love theme predominating. The titles are: I Love How You Love Me — I'm Not In Love — There's A Kind Of A Hush — All My Loving — Never Gonna Fall In Love Again — Fairytales — Rosegarden — If — I Get A Little Sentimental Over You — Over The Rainbow.

The unnamed backing orchestra does an excellent job and the quality is good. (N.J.M.)

★ ★ ★

A BUTTERFLY FOR BUCKY. Bobby Goldsboro. United Artists L 35958. Festival release.

Bobby Goldsboro still sounds the same as ever, and he still sings the same kind of heart stretching (or should that be retching?) songs. If you like it, well and good, but I must admit that I didn't.

The ten tracks, in order are: A Butterfly For Bucky — She Taught Me How To Live Again — Best To Be Free — Chippin' Away — Another Night Alone — Love Me The American Way — Reunion — Kids Are People Too — Cuddle Up — I Wrote A Song (Sing Along).

Record quality is reasonable, with lots of big orchestral sounds to fill in the spots where Bobby can't think of what to say! (D.W.E.)

"Best piece of nostalgia.."

SONGS OF YESTERYEAR. Various artists. Reprocessed mono, EMI, SCA-009.

There is an obvious and important difference between re-issues of old stage and screen recordings, and of old recital performances, as here. In the first case, the effect is often to emphasise the mediocrity, as singers, of many one-time stage and screen identities. In the second, to emphasise the genuine, if traditional, talent of the professional singers of yesteryear.

Here, EMI engineers have done a superb job in re-mastering a whole array of performances which many of my generation will remember well:

Tiritomba (Joseph Schmidt) — I Dream Of Jeannie (Jussi Bjorling) — Old Man River (Paul Robeson) — Vilia (Gladys Moncrieff) — Pedro The Fisherman (Richard Tauber) — The Good Green Acres Of Home (Peter Dawson) — Mama (Beniamino Gigli) — Take A Pair Of Sparkling Eyes (Webster Booth) — Ave Maria (Gracie Fields) — Tarantella Sincera (Tino Rossi) — The Mountains Of Mourne (Peter Dawson) — Tell Me Tonight (Jan Kiepura) — The Green Hills Of Somerset (Joan Hammond) — Today Is The Happiest Day Of My Life (Joseph Schmidt) — Drinking (Oscar Natzka) — Goodbye (Richard Tauber) — La Paloma (Beniamino Gigli) Believe Me If All Those Endearing Young Charms (John McCormack).

The best piece of nostalgia I've heard in many a long time. (W.N.W.)

JIMMY LITTLE, Travellin' Minstrel Man Festival L 36083.

Jimmy Little has been around as a fine singer of ballads for a good time and this album demonstrates some of the reasons for his popularity. There are a dozen country flavoured titles on the disc, including: Walk When Love Walks—Where The Blue Of The Night Meets The Gold Of The Day—Lonely Rain—Say It Again—Please Don't Tell Me How The Story Ends—Heavenly Sunshine—If I Miss You Again Tonight—Travellin' Minstrel Man.

The Quality is really good, with unobtrusive backing, an album to enjoy. (N.J.M.)

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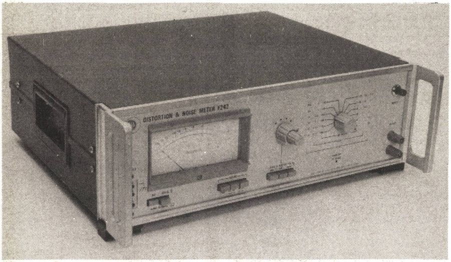
New Products

AWA F242 Noise & Distortion Meter has auto-nulling

Designed and manufactured in Australia, the AWA F242 Noise and Distortion meter has fully automatic nulling on fundamentals in the range 20Hz to 20kHz for distortion measurements down to 90dB or .003%. It will also measure signal levels, noise and hum-plus-noise in the frequency range 10Hz to 100kHz.



Since the Australian electronics scene is so overwhelmingly dominated by imported products and technology, it is refreshing to find a refined piece of equipment like the AWA Distortion and Noise Meter which is both designed and manufactured in Australia.

What is even more gratifying is that this product is in a category where there are few competing manufacturers. Success would seem assured.

Dimensions of the instrument are 430 x 146 x 397mm (W x H x D) and mass is 7.1kg. It is fitted with a tilting bail for bench use or can be mounted in a standard 483mm (19 inch) rack in which it occupies a height of 133mm with feet removed.

The F242 will operate from 120V or 240VAC nominal mains supplies and is fitted with a detachable three-core mains flex with moulded three-pin plug.

Control layout of the instrument is quite simple compared with instruments employing manual nulling. The main attenuator has twelve 10dB steps while the subsidiary "cal" control has a range of four steps or 40dB combined with a concentric knob for continuously variable control. Nine pushbuttons complete the control facility.

Input connection is via a Siemens-Halske type 9 socket which accepts a standard male plug or banana plugs. Alternatively, the instrument may be fitted with twin jacks for carrier or ring, tip and sleeve plugs. A pair of terminals on the right-hand side of the front panel provide an output signal to enable the distortion products to be monitored on an oscilloscope.

Measuring harmonic distortion with the F242 is a simple routine. Feed in a signal from the source with an amplitude of 300mV RMS or more and anywhere in the frequency range 20Hz to 20kHz. Press the "cal" button to set FSD on the meter, using the associated attenuator. Then push the "read" button and a bunch of relays inside click a few times while the instrument nulls automatically down to .005% within about 5 seconds.

The operator can switch the main attenuator down while nulling is in progress to achieve a final reading on the upper part of the meter scale. Subsequent readings at different signal levels and/or frequencies can be made without the need to switch the main attenuator up range again to set the "cal" level. The "cal" level can be checked at any time just by pushing the appropriate button.

Attempts to measure distortion of signal frequencies outside the range of the instrument cause a LED indicator to light. Bandwidth of the instrument for level and noise measurements is 10Hz to 100kHZ ±0.2dB for the unbalanced input condition and 10Hz to 30kHz ±0.2dB for the balanced input condition. Pushbuttons can be used to select sharp rolloff high and low filters.

There is also an optional CCITT weighting filter. This will probably become the standard filter for all audio weighted noise measurements. It boosts frequencies in the range 3kHz to 10kHz by up to 12dB, introduces a sharp rolloff above 10kHz and cuts frequencies below 1kHz at the rate of 6dB/octave. Thus it attempts to give a fair assessment of noise audibility in audio equipment.

Anyone who has used a manually nulled distortion meter will find the AWA F242 a dream to use. It almost drives itself.

We did find one small drawback concerning the input attenuator. This provides a maximum voltage range of 30V RMS which is inadequate when testing audio amplifiers with a power capability in excess of 100 watts. Competitive distortion test sets have maximum voltage inputs of 100 volts or 300 volts RMS.

A unique and very worthwhile feature of the F242 is the "true RMS" meter circuitry. As far as we know, this AWA distortion meter is the only one with this feature. Other instruments use "average indicating" meter circuitry which is calibrated to read RMS values for sine waves. This necessarily leads to errors when reading the values of non-sinusoidal waveforms such as square waves, distortion products and noise.

So on the basis of its "true RMS" meter circuitry, this is the most accurate and precise THD meter currently available. Even so, there are competitive units which will measure THD down to lower limits.

Internal layout of the instrument is very neat and almost devoid of any interconnecting wiring. Most of the circuitry is accommodated on a very large PC board which occupies almost the entire chassis. Access can be gained to both sides of the PCB by removing top and bottom halves of the case.

The automatic nulling circuit consists of three sections: the Wien bridge with associated amplifiers, a nulling circuit to control the variable resistors in the bridge and automatic bridge control cir-

Musicolor III kit from Dick Smith Electronics

The Dick Smith Electronics Group has produced a new kit of the Musicolour III, complete with heavy gauge gold anodised front panel and 16-page instruction manual. The Dick Smith Guarantee applies to the kit, so that for a fee of $10 a malfunctioning unit will be repaired.

The kit arrives neatly packed in a corrugated cardboard carton. Components are grouped according to type and packed in plastic bags. All the major components plus the small plastic bags are sealed in a large plastic bag, so that nothing should go missing in transit.

The steel chassis is cadmium plated and passivated and the wrapover cover is black Marviplate. The front panel is 10-gauge aluminium with a gold anodised finish matching that on the front panels of the popular Playmaster Twin Twenty Five and Forty/Forty amplifiers also supplied by Dick Smith Electronics.

Front panel layout is changed from our prototype but that does not affect operation in any way. The panel is separately packed in a plastic bag to avoid scratches.

We did not assemble the kit but it appeared to be complete in every detail. All the components were of good quality and while there were a few substitutions, these were close equivalents.

A well-written instruction manual is a major feature of the kit. It has many photographs and diagrams which should help even the most tentative novice to achieve a successfully completed Musicolour.

We took issue with one point in the manual: under the heading "Input Protection", the Musicolour is stated to be "Transformer coupled, isolation rating much greater than 240V." While the insulation of the transformers may withstand more than 240VAC, that statement could possibly cause some constructors to take dangerous liberties with the design. A spokesman for Dick Smith Electronics assured us that this would be corrected at the next printing of the manual.

Assembly of the kit is described in a detailed step-by-step procedure which is easy to follow. And the colour code for each individual resistor is listed.

With over a thousand Musicolour III kits built at time of writing, this new kit is sure to be successful. Price of the full kit is $55.00 or $32.50 without metalwork.

AWA F242 Noise & Distortion Meter

cuits. The Wien bridge has sixteen separate ranges to cover the whole band. These ranges are selected by relays.

Space does not permit us to even briefly describe the circuit operation which is detailed in the comprehensive instruction manual. This not only gives a full circuit description and service instructions but also supplies complete specifications, circuit diagrams and complete parts lists.

To sum up, we were most impressed with the AWA F242 Noise and Distortion meter. Its automatic nulling over the whole audio range, without the need for frequency selection, and its true RMS meter, make it a refined instrument which is easy to use. At the price of $1250 plus sales tax where applicable it is already finding wide acceptance in the broadcasting and audio field.

Further information on AWA test instruments can be obtained from the Engineering Products Division of Amalgamated Wireless (Australasia) Ltd, 422 Lane Cove Road, North Ryde, NSW 2113. (L.D.S.)

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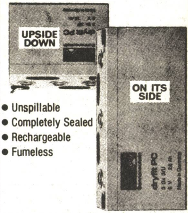

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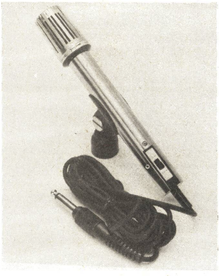


The new Primo model EMU-4517 microphone is of the electret type. It features an inbuilt matching preamp, which gives an output impedance of 2k ohms. The preamp is powered from a single penlight cell which fits in the body of the mike, with an on-off switch to save the cell when the mike is not in use.

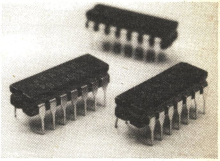
The EMU-4517 has a cardioide or "unidirectional" characteristic. It comes with a clip-in adjustable stand adaptor, and a cable fitted with a 7mm jack plug. No frequency response figures were supplied, but tests on a sample unit suggest that the response extends smoothly over the full usable range.

Priced at $26.50, the Primo EMU-4517 is imported by Paradio Electronics. It is available from Radio Despatch Service, Pre-Pak, Magraths, and Willis Trading.

Relay drivers

RIFA Electronics have added two new inductive load drivers to their range of interfacing ICs. The PBD3513 is a dual 3-input AND device in a 14-pin DIL pack, the PBD3520 a single unit in a metal TO-99 pack. Inputs are TTL compatible and the PBD3513 can sink 300mA.

Enquiries to Rifa Electronics Pty. Ltd.



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CM 6034/DA 4 outlets 8 dB each	54.90
CM 6036/DA VHF 30dB UHF 28dB	84.63
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KINGRAY AMPLIFIERS	Price
D15/500 m/V	$48.80
D30/500 m/V	57.95
D40/600 m/V	79.30
D12/1500 m/V	67.10
MH 20 mast Head 300-75 ohm	64.63

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20ft	$19.30
30ft	$30.81
40ft	42.00
50ft	54.42

18g steel in 10ft sections must be guyed.

CDE AR.22 Rotator $86.00

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ALL TYPES OF HARDWARE IN STOCK
Wall Brackets, Chimney Mounts, J Brackets, Guy Rings & Guy Wire. Masts from 8ft to 50ft. ETC

Detects speed measuring radar

The Senturion radar detector is manufactured in the United States by Radatron Corporation of New York. The unit is easily installed in most vehicles, and comes complete with mounting extras, power cables and a twelve months' manufacturer's guarantee.

Some people will undoubtedly be annoyed because we have chosen to feature a radar detector in the magazine, regarding their use in a motor vehicle as being anti-social. Others of course will take the view that police radar speed units are only a means of earning revenue for the state's "coffers", and of little or no value when it comes to road safety.

We will not buy into the argument here. Suffice to say that, on the information we have, it is perfectly legal to operate radar detectors like the Senturion from your car.

The Senturion is not a compact unit, and could protrude on the interior of some cars. Dimensions (excluding the large antenna horn) are 150mm x 75mm x 94mm (W x H x D). The unit is housed in a black crackle finish metal case, relieved only by an off-white plastic front panel.

Protruding through the rear end of the case is the antenna horn "business end" of the Senturion. This contains two separate mixer diodes situated at different distances from the back plane of the horn cavity in what is apparently a broadband configuration. The detector should be mounted so that the antenna horn "looks" forward through the windscreen of the vehicle, and has an unobstructed view of the road ahead.

Visual and audible alarm systems are used to warn the driver when radar is detected. The visual alarm is simply a front panel-mounted lamp that glows behind a yellow plastic bezel. This bezel can be pulled out to allow for lamp replacement. A small speaker mounted behind the front panel to the right of the lamp provides the audible alarm.

In keeping with its designated purpose, operational controls on the Senturion have been kept to a bare minimum. There is just one control on the front panel—the sensitivity control—and this is normally adjusted before the commencement of a trip. A simple slide switch on the rear panel allows the speaker alarm function to be switched in or out as desired.

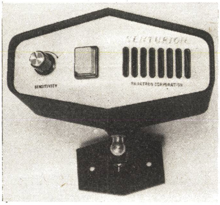
Power for the unit is derived from the vehicle's electrical system, the requirement being a supply rail of +12V DC. A two wire cable with a cigarette lighter adapter attached to one end is supplied for this purpose. An RCA plug at the other end of the cable makes the connection to the detector unit.

Two different mounting options are provided with the unit: pedestal mounting and sun-visor mounting. Pedestal mounting is facilitated by means of custom baseplate (supplied) which can either be screwed to the dash or affixed using special hook and loop material. The detector is then mounted in position and aligned, making use of two ball and socket joints.

The hook and loop method, by the way, makes it easy to remove the unit from the vehicle when desired.

A spring loaded clip at the top of the unit provides the alternative sun-visor mounting arrangement. This clip can be detached from the unit if not required, as can the ball extension on the bottom of the detector.

The effectiveness of radar detectors like the Senturion could be a matter for some debate. We were unable to check the performance, as no police radar was encountered during the test period of several weeks (there must be a proverb here somewhere). What is interesting to note is that the manufacturer has made no extravagant claims.



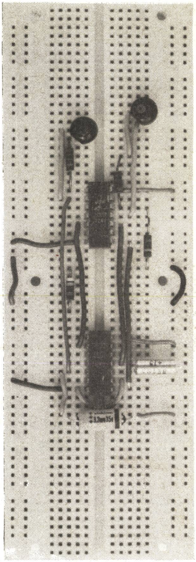
A driver's view of the Senturion unit.

Indeed, the literature supplied points out that since radar beams travel in straight lines only, the Senturion "cannot 'see' over hills or around corners. However, because of the cone shaped beam and the possibility of reflections or scatter, the Senturion may give advanced warning in these situations. But, do not count on them."

Under more favourable conditions, it is claimed that the Senturion will detect radar beams at up to twice the tracking distance. In some situations, the Senturion could also provide adequate advance warning due to general traffic conditions between the detector and the police radar.

Cost of the Senturion radar detector is $115 (plus postage). The unit is available from Dick Smith Electronics Pty Ltd, PO Box 747, Crows Nest, NSW 2065; or from Dick Smith stores in Sydney, Brisbane and Melbourne. (G.S.)

SK-10
EL-SOCKET
UNIVERSAL BREADBOARDING COMPONENT



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220uF	10v	10 for $1
0.39uF	160v	10 for $1
500 MFD	12v	5 for $1
70 MFD	45vac	5 for $1
47uF	160v	5 for $1
6.8uF	1500v	10 for $1
15uF	400v	5 for $1

SUPER QUALITY CROSS OVER CONDENSERS FOR 8/OHM SPEAKERS 50 CENTS.

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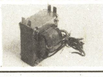

SPEAKER TRANSFORMERS

7000 to 15/OHMS $1.75
1200 to 15/OHMS $1.75
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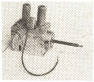
TRANSISTOR 7 RADIO

Complete with 3½ inch speaker
No cabinet **$3.95**



T.V. TUNERS
Pye Eaf 002
Complete with valves **$5**

B.S.R. CERAMIC STEREO

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Pick up Cartridges
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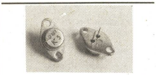
SPECIAL COLOUR TV CHASSIS & BOARDS

Some complete **$1 to $20**
Counter sales only on these items.



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162 K5 **$2.50 A PAIR**

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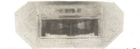

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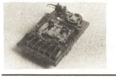

$10.

SPEAKER SPECIAL

2¼ INCH 8/Ohm 2 for $1.

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5AS4	$1.50	66J6	$1.50	6BN8	$1.50	17Z3	$1.50
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6BM8	$1.20	6BR5	$1.50	6AB4	$1.50	6BX7	$1.50
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6CM5	$1.50	6BJ5	$1.50	6BW8	$1.50	11AR11	$2.00
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IS2	$1.20	6A28	$1.50	1X2B	$1.50	6BA8	$1.50
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6AC1	$2.00	6BJ5	$1.50	6V9	$1.50	ECC89	$1.50
6CZ5	$1.50	12AT6	$1.00	6V9	$2.00	6CH6	$1.50
3S4	$1.00	15CW5	$1.50	6U9	$2.00	12AX4	$1.50
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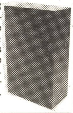
6AB8	$1.50	6DB5	$1.50	50EH5	$1.50	1954	$1.50
6EB8	$1.50	EBF89	$1.50	6C15	$1.50	6A24	$1.50
E88CC	$1.50	6DC8	$1.50	6AK5	$1.50	EV86	$1.50
50EH5	$1.50	30AE3	$1.50	IT4	$1.00	6AM6	$1.50
UCL82	$1.50	12AX4	$1.50	6CD7	$1.50	9AK8	$1.50
6AH6	$1.50	EF39	$1.50	PCL83	$1.50	6DC8	$1.50
6SA7	$2.50	EF6	$1.50	12AQ5	$1.50	UBC81	$1.50
6BQ6	$2.00	15CW5	$1.50	6BK7	$1.50	6BW8	$1.50
1B3	$1.50	6AU5	$1.50	6JN8	$1.50	PCC84	$1.50
6BC8	$1.50	6BF5	$1.50	16A5	$1.50	7AN7	$1.50
EM84	$1.50	50EH5	$1.50	6BN4	$1.50	9JW8	$1.50
12AU7	$1.00	6ES6	$1.50	6DB5	$1.50	PCF802	$1.50
GEA8	$1.50	UF41	$1.50	6DA6	$1.50	6CU8	$1.50
1S5	$1.50	35W4	$1.50	6DJ8	$1.50	7DJ8	$1.50

T.V. Tuner $10



SPEAKER CABINET including 2 dual cone speakers, 6½ inch 10watts RMS **$16.** Size 16½ x 10¼ x 8. Pack & post Interstate **$5** a pair, NSW **$3.00.**

STEREO AMPLIFIER tuner 5watts per channel, complete ready to use, shop soiled **$25.00.** Pack & post **$1.50.** Interstate **$2.50.**

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Fuses ¾ amp ... 10 for $1
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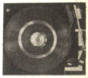
4B 25C90 1A **$3**

Super Special



B.S.R. Record Changer 12 inch turntable Balanced Arm cueing device etc. **$35** pack and post $2 interstate $2.50

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Gramophone Motor & Pickup
B.S.R. 4 Speed
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10 Different Values **$2**

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Hook up wire 30 mixed colours $1.
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SPEAKERS SPEAKERS SPEAKERS

6½ Inch Dual Cone 4 ohm	$5.00	Magnavox midrange 5 inch dual cone	$8.00	MSP 6 ×4 47 ohm	$3.50
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Special 12 inch dual cone MSP TACX 8 ohm	$8.00	Rola 5×4 inch 3½ ohm	$3.00	ROLA 6×9 47 ohm	$6.00
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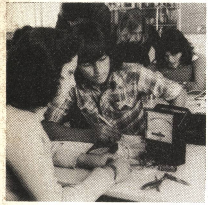
5×7 in 8 or 15 ohm	$5.00	Magnavox 5 inch 4 ohm 8 Watt	$5.00	Pioneer 3½ inch 45 ohm	$3.50
6½ inch 8 or 15 ohm	$4.50	Magnavox 5 inch 15 ohm	$4.00	Magnavox 6×9 inch 3½ ohm	$5.00
8×4 8 or 15 ohm	$4.50	Philips Gramophone Motor & Pickup 6 volt	$5.75	Magnavox 5 inch mid range 8 ohm	$6.00
6×4 8 or 15 ohm	$3.50	Pioneer horn-type Tweeter 3 inch	$9.50	MSP 8 inch dual cone 8 inch	$5.00
5×4 15 ohm	$2.50	Magnavox 6 inch 3½ ohm	$5.00	Magnavox 10 inch dual cone 15 ohm	$10.00
4 inch 8 ohm	$2.75	Pioneer horn-type Tweeter	$12.00	MSP 4 or 5 inch 3½ ohm	$3.50
5 inch Tweeters 8 ohm	$3.50	Pioneer midrange 5 inch	$9.50	MSP 4 inch 120 ohm	$3.50
6 inch Dual Cone Tweeters	$6.00	MSP 6×2	$3.50	4 inch 120 ohm	$4.50
5 inch Magnavox Dual Cone 8 inch 27 ohm	$6.00	MSP 4×2 5 ohm	$2.50	2¾ inch 33 ohm	$2.00

Electronics in the classroom

Q: We are using the Operation Electronics kit in our school. However, about a quarter of the projects use mains power, and I'm reluctant to involve students with the mains. It seems rather a waste just to ignore these projects, though. Have you any suggestions?

A: At least some of these projects will run quite successfully from batteries. In particular, these are the one which use a transformer and rectifier circuit to produce low voltage DC. If you simply substitute for the supply with a battery whose voltage is equal to or only a little less than the transformer secondary voltage, all should be well. Choose a battery capable of delivering the current, though.

It may also be necessary to connect an electrolytic capacitor of say 100uF across the battery, with the correct polarity, to ensure that project operation is not upset by the possibly higher output impedance of the battery. The electrolytic capacitor should have a voltage rating equal to or greater than the battery voltage.



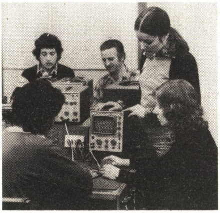
For those circuits which rely on the AC from the mains or a stepdown transformer, you could insist that no project is connected to the mains unless you have inspected it for safety. It might also be possible to mount the transformers in sealed boxes, with only the low-voltage side accessible.

Q: A group of my students are building up the train controller project in the Macmillan Operation Electronics kit (project 13, level 2). However, they were sent a BC549 transistor instead of the BD108 specified. Will this operate as well, and are the connections the same?

A: Yes, the BC549 should operate quite satisfactorily, although it is a higher gain device. The connections should be very similar, as the centre base lead is normally cranked to form the same triangular lead configuration of the earlier metal package used for the BC108 device. Incidentally, the BC548 is the modern moulded-plastic equivalent to the BC108, so that it too would be OK.

If you are ever uncertain of the lead connections for a bipolar transistor, they can be checked fairly easily using a multimeter. We gave details of this in the November 1968 issue, and reprints are available via the Information Service (quote file number 7/VT/6). Details are also given on pages 127-129 of the Macmillan Operation Electronics Manual.

Q: The crystal set given in project 8 of the Macmillan kit doesn't have any tuning capacitor like the circuit given in the manual. Will it tune all the stations?



At left, students measure the current gain of a transistor. Above, students investigate tone control operation.

A: Presumably the coil with its 100 turns of wire has sufficient self-capacitance to resonate in the normal broadcast band, so that it needs no additional capacitor. Note that the parts list has an omission, though: the coil needs 12.25 metres of wire (the "metres" apparently became lost somewhere in the printing).

"Electronics in the Classroom" is a feature to help school students and teachers with any problems arising from school electronics courses. If you have a problem you would like answered in the magazine, send it to Electronics Classroom, c/o Electronics Australia, PO Box 163 Beaconsfield, NSW 2014. We regret that we cannot answer your queries by mail.

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COUGAR 23 B AM DELUXE TRANSCEIVER
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Deluxe mobile 23 channel (synthesised) for the quality conscious Novice. The Cougar features built-in swr meter, noise blanker, delta tune, rf gain control, mic gain control, built-in modulation meter, separate PA switch. Circuitry consists of 1 IC, 20 transistors, 18 diodes, RECEIVER: dual conversion, sensitivity 0.5uV for 10dB S+N/N, selectivity 6 dB bandwidth 5kHZ, PA audio power 5 watts. TRANSMITTER: 5w input, spurious harmonic suppression better than 55dB. Comes complete with mic, mobile bracket, dc cable and manual.

HURRY LIMITED QUANTITY
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Xtal SCB7. This amazing AM unit features: Delta Tune—PA Switch—Automatic noise limiter—Transmit receiver indicators—Large S meter & volume control on microphone.

DELTA TUNE
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FAIRMATE CB TRANSCEIVER AC-500
—FCC Accepted — Variable Squelch — 23 Channel — On/Off Volume Squelch — Delta Tuning — Receive Transmit Indicator Lights — ANL Switch — PA & External Speaker Jacks — Push to Talk Dynamic Mic. — S/RF Meter — PA Switch.

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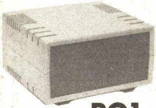

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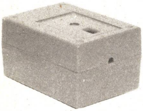

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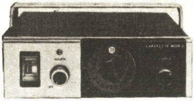

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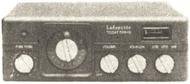

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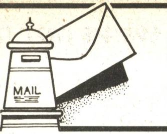

Letters to the editor

Metalwork in NZ

In the November issue of Electronics Australia you published a list of manufacturers able to supply PC boards, metalwork, chassis, etc. However, no chassis supplier was listed for New Zealand. Perhaps you would inform your readers, particularly those in New Zealand, that our company is able to supply both stock and custom metalwork at very reasonable prices. We will also make special items such as the tinplate shields for the TV game in the May 1976 issue.

R. W. Curwood
Metric Metals (G. W. Dodds Ltd)
196 Wordsworth Street
Christchurch 2, New Zealand.

Microprocessors

This is an attempt to answer the points made in your December 1976 editorial.

I think it is true that computer professionals (myself included) have not taken microprocessors seriously enough. There are several reasons for this. Perhaps there are some of us who feel that they are part of "a white-coated priestly caste", but I doubt it. Our lack of interest can be ascribed to more mundane motives, one of which is probably just lack of foresight.

Alternatively, they see the whole history of computing, complete with all its failures and misconceptions, repeating itself on a slightly smaller scale at much higher speed.

Another, more serious impediment to the use of microprocessors, relates to the difficulty actually getting medium-scale applications up and running on them. Experience shows that, except for trivial applications, development time depends upon facilities available. Hand-translation of programs into proms is a tedious and error prone business.

Computer professionals are accustomed to working with software capable of simplifying these problems, and have become accustomed to systems with cassettes or discs for holding programs and loading them into ram at reasonable speed. All of these facilities have been found desirable for program development on a reasonable scale.

It may be that computer personnel have been amiss in not seeing the microprocessor as a vehicle for new and simpler applications but their judgement that the device has not yet, or only recently, been provided with software and peripherals suitable for general computer applications is, I fear, correct.

And this is where the hobbyist comes in, together with the electronic engineer. The hobbyist has time and money, and the electronic engineer problems which can be solved by devices containing programs of a few tens or hundreds of bytes. A serious reader of electronics engineering magazines issuing from the U.S. would by now have seen a large number of articles on all aspects of microcomputers, from the technology through to programming languages. In fact, there has been no shortage of professional comment. Serious material in these publications goes back to at least 1973.

In the meantime, the computer professional, reluctant to regress to the days of hand-coded and loaded assembly programs and paper tape has waited for the new devices to catch up.

However, the coming of age of microprocessors is intimately linked with the computer types since it is they who have solved the problems of language translators and operating systems. This fact is slowly being recognized by the major microprocessor producers who are busy buying up talent in this area. Unfortunately, mini-computers, while "capable of being driven by mere engineers", have frequently turned out to be expensive toys, under utilized and poorly configured, creating a false impression about the problems of using computers effectively.

Magazines such as E.A. are clearly performing a service, but they should not overrate their contributions. With all due respect, much of the programming is trivial by normal standards and I have yet to see a genuinely useful domestic or automotive project in such a magazine although I watch with bated breath.

Karl Reed
Computer Centre, Monash University,
Clayton, Vic.

COMMENT: You seem to assume that microprocessors will mainly be used for conventional computing. In fact such applications are likely to be dwarfed by their enormous potential as programmed "black boxes", and your criteria for effectiveness thus inappropriate. Our own efforts may be modest, but there is a lot of very basic information to provide during this initial phase of the learning curve. We're not getting much help from professionals who adopt an attitude of aloof condescension.

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Circuit blockbuster

MASTER HANDBOOK OF 1001 PRACTICAL ELECTRONIC CIRCUITS. Edited by Kendall Webster Sessions. First edition 1975, published by TAB Books. Stiff paper covers, 602 pages 13 x 21 cm, predominantly circuit diagrams with captions. Price in Australia $11.95.

According to the preface, most of the circuits in this book have come from "73" magazine, while others have been taken from the application data released by semiconductor and component manufacturers. The circuits should therefore represent a good starting point for the experimenter who wants to devise complete projects of one type or another.

Faced with over 600 pages and 1000 circuits, the newcomer is as likely to be confused as someone who has been dumped unceremoniously into the middle of Disneyland! There's so much to look at . . .

The author has helped, however, by dividing the book into 20 sections which I list briefly: Alarms, sensors etc – Audio conditioning – Audio amplifiers – Automotive – Filters – Logic, counters, clocks – Power supplies – Receivers etc. – Regulators – RF generators, waveshapers – RF power amplifiers – Test equipment – Control & tone circuits – Timers – Transmitters etc. – Battery chargers – Diode circuits – Miscellaneous – IC substitution guide – Electronic symbols.

Over the back is a detailed index which should be of further assistance in pinpointing wanted ideas.

The circuits are virtually all solid state and are relatively modern, in that they represent what was in the literature in the period up to mid 1975. They vary in complexity from simple single-stage hookups to the relatively complex kind of thing that one would expect to find in the context of logic and counters. However, irrespective of complexity, the individual circuits are covered by little more than a title and a few words, or at most a few lines, explaining what they are intended to accomplish. Everything else is up to the constructor who must obviously be familiar with circuit diagrams, connection data and the mechanics of translating such basics into working projects. Fortunately for journals like EA (or thanks to journals like EA) there are quite a few such people around nowadays!

So buy your copy, get out your box of bits and see where you finish up. Divorced?

Our review copy came from the Technical Book Co, 295 Swanston St, Melbourne 3000. (W.N.W.)

Substitution guide

TRANSISTOR SUBSTITUTION HANDBOOK, 15th edition, first printing 1975. By the engineering staff of Howard W. Sams. Published by Howard Sams & Co Inc. Stiff paper covers, 215×135mm, pages not numbered, 22mm thick. Price in Australia $5.40.

If you needed any convincing as to the number of transistor types that have been produced within the last couple of decades, this Howard Sams book should do the trick. It has no author in the usual sense. Instead any number of un-named people patiently fed into a computer store a standardised set of physical and electrical parameters for as many transistors as they could identify. They also supplied the computer with the type numbers of equivalents suggested by the respective manufacturers, and those no longer in production. This done, the computer was bidden to do its thing.

What emerged was a printout of transistor types in the planned sequence, followed by equivalents computer-selected by reference to the stored parameters. Manufacturers' suggested equivalents also appear, distinguished by an asterisk. Types which are known to be discontinued appear in italics.

A small section at the end of the book lists general-purpose replacement types for various major circuit applications, presumably to assist where a doubtful transistor is distinguishable only by its role.

About the first 40pc of the book is taken up with "2N" type numbers (up to 2N6520) followed by other local type numbers and an array of what the American authors regard as "foreign". No data is given on individual types—just replacement suggestions.

You will have to be the judge of your need for a comprehensive substitution handbook but, if you want one, $5.40 isn't all that much to pay. You can get a copy from Dick Smith Electronics, catalog number B-1259. (W.N.W.)

Radio handbook

1977 WORLD RADIO AND TELEVISION HANDBOOK, 31st edition published in Denmark by Jens Frost. Contains 528 pages, including Listen to the World.

The 31st edition of the handbook lives up to its reputation as being the world's best directory of international broadcasting, and continues to provide an unsurpassed reference for the radio listener and professional broadcaster.

The information has been completely updated and covers a wide variety of subjects as well as containing essential information for the radio listener. Complete details are given on every radio and television broadcasting station in the world listed both geographically and by frequency. As well as the usual chapters on solar activity, broadcasts in English, the world's set count, maps showing the location of the main broadcasting organizations, information on standard frequency stations, religious broadcasting organizations and the like, the 31st Edition features a photographic series on How the DX Session Goes to Air based around Arne Skoog's "Sweden Calling DXers". The special supplement called "Listen to the World" includes such articles as the Prolonged Sunspot Minimum, International Broadcasting in the 1980's, Satellite Age and The Citizens' Band.

There are over 40,000 copies of the 1977 edition in print and stocks are available from technical book stores throughout Australia. Readers can also obtain a free brochure and other details from the sole New Zealand agent, Arthur Cushen, 212 Earn Street, Invercargill, NZ (A.T.C.).

Editors Note: A review copy has also been received from Technical Book and Magazine Company Pty Ltd, 289-299 Swanston St., Melbourne, who advise that they have stocks available at $11.95 plus postage.

Electronic organs

SOURCEBOOK OF ELECTRONIC ORGAN CIRCUITS, by Alan Douglas and S. Astley. Published by Tab Books, Pennsylvania 1976. Soft covers, 210 x 130mm, 167pp. Many circuits and diagrams.

This is apparently a US republication of Transistor Electronic Organs for the Amateur, third edition, published in the UK by Pitmans. As both titles suggest, it is basically a collection of circuits and other information on electronic organs, intended to help the home builder.

No doubt some of the circuits will be of interest and use to such people, although there is little on modern techniques like MOS keying or note synthesis and division. There is also quite a bit of evidence that the book has been put together with more haste than care.

The review copy came direct from the publisher. (J.R.)

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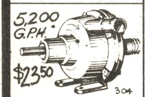

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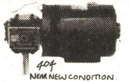

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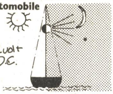

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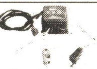

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Type 8156. This power unit was made by "Meccano", England for the Australian market. A special purchase enables us to sell at this low price. The unit is complete with two accelerators which are enclosed slider resistors with thumb control on slider for adjusting output voltages. Each has 3' of lead. Input is 240 volts AC. 50 c.p.s., two outputs are 26 volts AC at .63 amps and 26 volts AC at .63 amps or use together 26 volts AC at 1.3 amp. The unit can also be used as a 24 VOLT DC POWER SUPPLY with selenium rectifier extra $1.50. The unit on test for 24 hours gave 3 amps cont. without activating thermal relay. The unit is fully protected with inbuilt thermal relay. Housed in metal case with 6' lead and plug. Brand new in carton with instructions. Also used as 24v battery charger.

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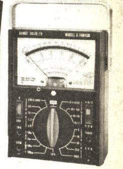

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BATTERIES $2.00 PER PHONE.

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The Amateur Bands

by Pierce Healy, VK2APQ

WIA policy on citizen radio

Discussions relating to the lobbying for a citizen band radio service in Australia and the attitude of amateurs to such a scheme has brought forward suggestions as to how the matter could be resolved.

Notes on several matters of interest to Australian amateurs have been received from the federal president of the Wireless Institute of Australia, (Dr David Wardlaw VK3ADW) through the Federal Executive office Melbourne.

Among them was a copy of the submission made by the executive to the Minister for Post and Telecommunications following the release of a discussion paper, prepared by his department on the question of introducing a citizen's radio service in Australia.

The Minister, Mr Eric L Robinson, referring to the paper, said: "it is a complex matter with many points of view existing in the community, not all of which are in favour of legalising CB radio. The paper is being released to stimulate further public discussion".

The text of the submission by the WIA executive was:

"This Institute, consistently and for as long as it has existed, has been concerned about illegal operation within the Amateur Service frequency allocations. These may be caused by intruders or pirates or by any other unlawful or unauthorised activity within Australia or emanating from any other country and affecting the lawful use of those frequencies here.

"The illegal use being made of the Australian Amateur Service 11 metre band shared allocation (26960 to 27230kHz) by unlicensed operators in recent times is of concern to this Institute.

"The Institute believes that as these illegal operators are demonstrating a need for personalised communications for the public it is essential that this need should be seriously considered without unnecessary delay. The three options set out in the report are considered to be useful for discussion purposes but should not eliminate the necessity for considering such other variations as would satisfy international obligations, acceptable administrative methods of regulation and control, and the removal of illegal operators from spectrum usage.

"If a 'CB' service is to be introduced into Australia this Institute, in common with other interests representing users of the frequency spectrum, has no option but to insist upon the following paramount priorities—

(a) proper and effective control measures must be observed and enforced at all times;
(b) the detection, apprehension and conviction of illegal stations and operators must be vigorously pursued both now and at all times; and
(c) adequate compensation is necessary if any existing Amateur Service allocation is withdrawn or reduced, or rendered virtually useless for ordinary amateur communication purposes.

"This Institute commends for the most serious attention those parts of the report relating to numerous problems experienced in the USA and elsewhere on the operations of the CB services in those countries. It should be added that as the Amateur Service licensees were suspended in the public interest during two World Wars any 'CB Service' must also be capable of being closed down on immediate notice. Any deployment of man-power to achieve this objective at a critical time should receive consideration.

"The Institute also wishes to set out what may be termed secondary considerations relating to the introduction of any new or expanded service. These are—

(a) real and potential interference to other services, equipment and facilities;
(b) the unlawful use of equipment for overseas communications;
(c) the ease of converting existing equipment for use on other adjacent, close or related frequency allocations;
(d) the exercise of intelligently administered controls over the importation and/or acquisition of equipment for any new or expanded service; and
(e) the establishment of any new or expanded service should be so designed as to create the minimum diversion of staff.

"These considerations relate in general to technical criteria. Both (a) and (b) as well as (d) have received mention in the report. In relation to (e) the relevance of paragraph 51 of the report must be noted particularly as Amateur Service affairs have been accorded such low priority for some years because of the staff situation within the Department. All offers of help by the Institute in specific areas have also been consistently rejected although consistently reaffirmed.

"It is the considered view of this Institute that a service for a 'CB' type of operation could be evolved which meets all the priorities listed and most of the considerations outlined in foregoing paragraphs.

"If a decision is reached in favour of establishing any new or expanded service it is recommended that a technical committee should be appointed to determine the essential parameters, specifications, limitations and controls. It would be the wish of the Institute that it should be officially represented on such a committee."

Extracts from submissions made by individual Divisions of the WIA were also included in the notes received. The Australian Capital Territory Division submitted four recommendations—

(i) persons wishing to make radio their hobby should take advantage of the present provisions for licensing in the amateur radio service;
"(ii) the present provisions for genuine and/or essential users of the 11 metre band continue and, if necessary, be extended;
"(iii) provision be made in the upper VHF or lower UHF region for operators who do not have the necessary expertise to understand the operation of their equipment;
"(iv) present legislation be amended to provide for stricter controls on sales of transmitting equipment. In particular, that retailers should only be permitted to sell transmitting equipment to purchasers who are in possession of a licence as suggested in (i) to (iii) above."

Representatives of the ACT Division also attended a public meeting in Canberra and emphasised the view that any request for a CB service had the best chance of success if the difficulties associated with the 11 metre band were recognised and embraced UHF channels. It was also suggested that WIA advice should be sought in investigating the advantages of UHF and dispelling the myths regarding costs and technical complications. Much emotive misinformation they thought stemmed from less responsible elements of the news media and vested interests.

The NSW Division does not object in principle to a CB service. This view has been stated or implied in most of the submissions, but they point out the unsuitability of the 11 metre band. UHF is suggested as far superior to the 27MHz band. Emphasis is laid on adequate control and policing by the Post and Telecommunications Department and concern is expressed on the apparent staff shortage within that department.

The South Australian Division submitted that any CB service must be properly regulated and should be licensed solely for short-range personal communications. It believes that existing amateur service facilities are adequate to satisfy the needs of those persons wishing to engage in the hobby of radio communications.

They suggest that any CB allocation should be on UHF—

"(a) as satisfying the technical requirements of reliable sort-range personal communications while minimising the possibility of unauthorised long distance hobby-type communications.
"(b) as minimising the possibility of interference to consumer electronic equipment and to other services (including CB itself),
"(c) to enable the Government to honour commitments to the ITU in respect to HF allocations,
"(d) to enable the allocation of a sufficient number of frequency channels to permit future expansion and,
"(e) to enable the use of FM equipment to provide a more reliable system."

The division also considered that legislation is necessary to prevent the further importation of substandard equipment for purchase by anyone, but recognised the large quantity of 27MHz equipment already in the country which might warrant continued usage for, say, three years. Hence novice licensees should be allowed an allocation in the 10 metre band.

The Western Australian and Tasmanian Divisions also favour UHF for CB service, and the latter also believes that amateur service equipment should not be available to CB operators.

WARC—1979; The WIA submission on WARC 79 has been passed to the chairman of the APO's committee No. 2 which it is understood, will prepare the case for the Australian Amateur Service.

The submission contains a great number of pages and took many months to prepare. It has drawn on material supplied by the International Amateur Radio Union both of a general nature and specifically referring to individual countries such as the USA, UK and Canada.

NOVICE LICENCE: There is no longer a two year tenure on the novice licence. Also, novice licensees will be authorised to use a segment of the 10 metre band as early as this can be arranged. The institute has suggested the segment 28.1MHz to 28.3MHz be allotted.

CALL BOOK: Discussions are still being held with the P&T Dept., and the publication of the 1977 call book is unlikely before the latter part of the year. It

Radio clubs and other organisations, as well as individual amateur operators, are cordially invited to submit news and notes of their activities for inclusion in these columns. Photographs will be published when of sufficient general interest, and where space permits. All material should be sent to Pierce Healy at 69 Taylor Street, Bankstown 2200.

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RHC 6566

is the intention to produce the call book using the Institute EDP membership details and the Department's records for non-members.

LICENCE FEES: The reduction of licence fees for aged and invalid amateur licensees is still in the system awaiting the necessary government legislation.

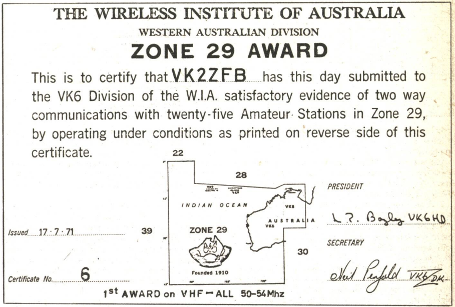
CONTEST ACHIEVEMENTS

Participating in contests and qualifying for special awards are just two of the many facets of amateur radio activities.

During discussions at the recent Gosford Field Day with Albert Birch, VK2ZFD, it was learned that he had been the recipient of two VHF awards of note; the "Zone 29 Award" sponsored by the Western Australian Division WIA, and the "ZL—Worked all Districts Award (VHF)", sponsored by the New Zealand Association of Radio Transmitters. Both were for two-way contacts on the six metre (50-54MHz) band.

Zone 29 encompasses the VK6 and VK8 call areas, and a large area of the Indian Ocean wherein lie the Cocos and Christmas Islands (VK9).

To become eligible for the award, the applicant must submit proof to the VK6 Division, of 25 contacts within the zone area. The contacts may be phone or CW on either HF or VHF. Since 1960, Albert has contacted 49 VK6 stations and 6 VK8's, all on 50-54MHz phone. Albert's certificate was the first for VHF operation issued under the "Zone 29" award.



THE WIRELESS INSTITUTE OF AUSTRALIA

WESTERN AUSTRALIAN DIVISION

ZONE 29 AWARD

This is to certify that VK2ZFB has this day submitted to the VK6 Division of the W.I.A. satisfactory evidence of two way communications with twenty-five Amateur Stations in Zone 29, by operating under conditions as printed on reverse side of this certificate.

Issued 17 : 7 : 71

Certificate No. 6

PRESIDENT L. R. Bayly VK6HD

SECRETARY Neil Penfold VK6DK

1st AWARD on VHF — ALL 50-54Mhz

The Zone 29 Award, showing the VK8, VK6, and Indian Ocean areas involved.

In relation to the "ZL—WAD" award, Albert has supplied a list of all Australian VHF Stations that have received the award. This is probably the first time the list has been published in Australia. It has been checked by Jock White, ZL2GX, the NZART awards manager, and is complete to the 25th February, 1977.

Certificate No.	Aust. No.	Call Sign
18	1	VK2VW
38	2	VK5RO
44	3	VK6DW
45	4	VK2HE (Dec'd)
46	5	VK3KC
47	6	VK3YS
55	7	VK2ABR
56	8	VK2MZ
57	9	VK5ZAX
58	10	VK5ZBZ
59	11	VK4ZAA
60	12	VK4TY
61	13	VK5ZGA
62	14	VK4WD
63	15	VK2ZVL
64	16	VK9XK
65	17	VK3ZIG
66	18	VK2ZFB
67	19	VK7ZAP
68	20	VK2ZVW
70	21	VK3ZCG
71	22	VK3ABA
73	23	VK3ZEO
87	24	VK4EG
88	25	VK2ASZ
89	26	VK3AMK
90	27	VK3ZNJ
95	28	VK3YJI

The first eighteen Aust. No. certificates were for contacts on 50MHz. The remainder were on 52MHz with the exception of No. 20 which was the first and only one issued for 144MHz and No. 28 which was the first via OSCAR VII satellite.

NORTH QUEENSLAND CONVENTION

The Townsville Amateur Radio Club will host the third Bienniel North Queensland Convention in Townsville over the weekend 23rd-24th July, 1977. Visitors from the cold southern states will be particularly welcome.

Registration forms and further details from the Convenor, N.Q. Convention, TARC, PO Box 964, Townsville, Qld. 4810. Telephone enquiries: Rod Prior, (077) 71 4687, (077) 79 7885; Peter Renton, (077) 71 4181, (077) 72 1236.

Registrations received up to 1st July will be eligible in a ballot for an early registration prize.

More details next month.

NORTH QUEENSLAND FLOODS

A Wireless Institute Civil Emergency Network (WICEN) was activated at Cairns from the 6th to 9th March, 1977 during severe flooding of the Barron River Delta following a week of heavy tropical downpours. VK4HM, the official station of the Cairns Amateur Radio Club, at the Cairns headquarters of the State Emergency Service, was activated in the early hours of Monday 7th March to assist SES communications with a network on two metres.

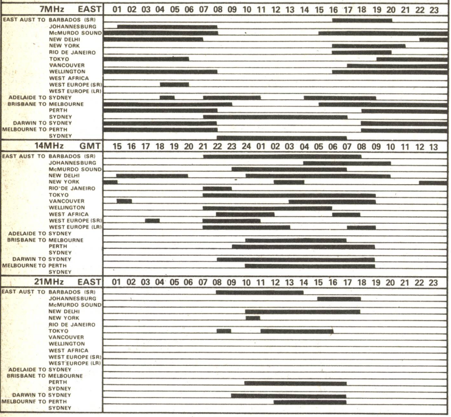
Ted Gabriel, VK4YG, WICEN coordinator, Nth. Queensland reports on the emergency work.

The river rose rapidly and flooded the Cairns suburbs of Machans Beach and Holloways Beach, forcing the evacuation of some 160 persons from their homes. Power was cut off, telephone services disrupted and roads to Cairns were closed. During this period, Ian Baty, VK4ZIB, at Machans Beach, had ten inches of water through his house but still managed to maintain contact with VK4HM.

At Caravonica, Wilf, VK4ZNZ, had problems with his two metre gear on Sunday 6th March but managed to negotiate flooded roads and borrow another unit from Barry, VK4ALK, at Yorkeys Knob.

IONOSPHERIC PREDICTIONS FOR MAY

Reproduced below are radio propagation graphs based on information supplied by the Ionospheric Prediction Service Division of the Department of Science. The graphs are based on the limits set by the MUF (Maximum Usable Frequency) and the ALF (Absorption Limiting Frequency). Black bands indicate periods when circuit is open. 5.77



Wilf had just gone mobile again when he was called to assist the SES in rescuing a man clinging to a tree in raging floodwaters.

Operators at WICEN control were—Ted Hudson, VK4MH; Ron Boland, VK4NU; Ted Gabriel, VK4YG and Mike, VK4AMO. Also operating an outstation in the flooded area was Nick Watling, VK4YT.

Ted also reports that the amateur population in North Queensland is growing steadily and there is not a lot of illegal operation in the Cairns area. The more sensible ones have accepted the invitation to join amateur radio clubs and be helped to obtain their licence.

There is a very close liaison between the amateurs and SES. Among these mentioned in the WICEN report the following are also SES communication officers VK4YG; VK4AMO; VK4ZIB and VK4YT.

ITU TROPHY

A radio amateur contest for the ITU trophy will be held to commemorate World Telecommunication Day. Sponsored by the Brazilian Ministry of Communication in conjunction with the Brazilian amateur radio organisation, LABRE, this competition was created eight years ago.

For telephony the competition will be held on Saturday 14th May, 1977 from 0000GMT to 2400GMT. The telegraphy period will be from 0000GMT to 2400GMT on Saturday 21st May, 1977.

In addition to the "ITU Trophy" there will be gold, silver, and bronze medals for the first three in both the telegraphy and telephony classes. The three highest scoring amateurs for each mode of emission in each country will be awarded diplomas.

RADIO CLUB NEWS

ELIZABETH AMATEUR RADIO CLUB: The venue for club meetings has been changed to the Elizabeth East Sea Scout Hall, Hornett Crescent, Elizabeth East. Meetings are held on the first Saturday of each month, at 8.00pm. Visitors are welcome.

In conjunction with the Elizabeth Community College, the EARC is conducting radio theory and Morse code classes to prepare candidates for the February, 1978 amateur examination. As more applications were received than could be accommodated this year, the club intends to run a further course in 1978.

The club station, VK5LZ, competed in this year's John Moyle Memorial National Field Day contest, as a portable multi-operator station at One Tree Hill, South Australia. Equipment was operated on the HF, VHF and UHF bands and over 200 contacts were logged. Because of the number of stations contacted who were unaware of the contest the club feels that the event should receive more publicity in future years.

Further information about the club from EARC, PO Box 8, Elizabeth, SA 5122 or club president, Ted Cooling, phone 255 2249 or 255 7586, or publicity officer Bill Thomas on 258 6070.

BLUE MOUNTAINS RADIO CLUB: This has evolved from the original Blue Mountains Branch organisation, and is just over one year old. It originated from a Youth Radio Scheme classroom conducted by Rex Black, VK2YA and its first crop of novice licensees. Through the efforts of the president, Peter Willis, VK2NET, the club has progressed and now has quite a large membership of novice, limited and full call licensees.

The club has two meeting places, the Springwood Primary School, every Friday night and at the Blaxland Primary School, on the first and third Monday of each month.

Because of the large attendances at the beginner's novice licence classes on Friday evenings Mr Karl Palmer, a science teacher from Springwood High School, is assisting Rex Black.

A regular feature is the Sunday night net on 3.54MHz at 7.30pm when discussion among club members and others is encouraged.

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Vic. 3104 P.O Box 162. Ph. 85 4061

ELECTRIC MOTOR
Speed controller kits. Will control any ac/dc brush type motor down to stop with no loss of torque.
Ten amp. capacity. **$10.95**
Five amp. capacity. **$10.25**

LAMP DIMMER
Kits. Will control incandescent lamps down to out.
Five amp. (1200 watt) **$7.25**
Ten amp. (2400 watt) **$8.50**

PLASTIC CABINET
Suitable for above speed controller & lamp dimmer. **$1.75**

BATTERY SAVER KITS
Will supply dc voltages from 6 to 15.
One amp. size. **$8.95**
Two amp.size. **$16.95**
Plus postage $2.50—Balance will be refunded.

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Will charge 12 volt wet batteries at 2 amps. **$10.25**
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Etching kits including piece of board, chemicals & instructions. **$4.95**

SPEAKERS
Aust. made MSP. High quality. Four inch 15 ohm. **$3.95**

CAPACITORS
Vertical can type. 2500mfd. 35vw. Three for **$4.00**
Single ended pcb mount. 2500mfd. 16vw. Four for **$2.00**

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● 1 mfd. 50vw. Eight for **$1.00**

AUDIO ALARM
Bell type VL-150-RM Continuous or intermittent 2900hz tone. 5/16 volts at 18/70 ma. Diode protected. **$13.95**

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MODULES. Sanken 10 watt. 20hz to 100khz. **$8.50**

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DPDT 6 terminals. Five for **$2.00**

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With cord and 3.5mm plug. Five for **$2.00**
PRICES include postage unless otherwise stated.
MINIMUM ORDER VALUE $2.00

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To achieve this aim, why not undertake one of the Courses conducted by the Wireless Institute of Australia? Established in 1910 to further the interests of Amateur Radio, the Institute is well qualified to assist you to your goal. Correspondence Courses are available at any time. Personal classes commence in February each year.
For further information write to

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EX ABC ¼" 2400 FT on 10½" REELS PROFESSIONAL QUALITY ONLY **$4.95. P.P. A. $1.10, B. $2.00, C. $2.25, D. $2.25.**

P.M.G. TYPE TELEPHONES

Standard desk type with magneto bell calling device. Range 30 miles. Uses standard batteries at each phone. Any number can be connected together on single line.

$35.00

(2 TELEPHONE SETS)

$2 Cartage to Rail. Freight payable at nearest attended Railway Station.

FOUR CHANNEL VHF TRANSCEIVER

125 to 140 M/hz. 28 volt DC operated AM single crystal locks both TX and RX on same channel complete with generator.

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T.U. Series. Contains variable condenser suitable for aerial tuning, vernier 5" Ceramic Coil Former, etc. 19" rack mounting, only **$9.50 ea.** Post A. $2.30, B. $3.75, C. $4.80, D. $6.55.

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1000 ft reels brand new original packing **$4.00 ea.** quantity available

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With headphones, accessories etc

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1 mile twin (2 miles) genuine ex-Army Don 8 perfect condition $35 per drum $2.00 cartage to rail freight payable at destination.

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Genuine ex-army Mk 3, liquid damped, as new $45.00 P & P A. $1.70, B. $2.25, C. $2.40, D. $2.65.

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$1.75
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$4.25
Post 60c.

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Provides a visual indication of signal output. Tests: electrode open circuits, short circuits, current gain. **$18.20 ea.**
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A compact and handy tester for workshop or lab where quick circuit checks are required

DC Volts 2.5 to 1.000V (20.000 OHMS per volt) AC Volts 10 to 1.000V (10,000 OHMS per volt) DC Current 50 UA 25 MA 250 MA. Resistance 40 K OHM, 4 MEG OHM Decibels minus 20 DB plus 62 DB complete with instructions only **$24.20** Ea. P.P. $1.05. Multimeter similar to above 30,000 OHMS per volt **$29.50** P.P. $1.05.

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Type B3
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522 Transceivers 100 150M CS

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65N7GT	**95c**	CV850	**$1.50**
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EF50	**75c**	832	**$5.00**
5Y3	**$2.25**	6X4	**$1.80**
2 x 2	**75c**	VR65	**75c**

P & P 40c

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Genuine eight day jewelled movement sweep second hand. Dash mounting. **$29.50 EA.** P. & P. $1.10.

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1½" Diam 4½" F.L. **75c** 2½" Diam 2" F.L. **$1.50** each. Or **$2.50** per pair. P & P 40c

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30 x 30
LENGTH 12½", HEIGHT 10"
WEIGHT 1¾ lb.
$27.50

45 x 40
LENGTH 16",
HEIGHT 10"
WEIGHT 2 lb.
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High grade coated lenses. Ideal for pistol and rifle ranges or general viewing. Zooms in from very low to high powers. Complete with tripods.

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7 x 50	**$39.50**
10 x 50	**$41.00**
12 x 50	**$42.50**
20 x 50	**$47.50**

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15X **$5.20** Post 60c

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Transmitter No. 11 suits 210 **$35.**
24 volt Power supply to suit above **$15.**
Or complete station with Headphones, Mic, Morse Key, Antenna **$110.**

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Plunger Type 12V 300MA. Suit electric camera control, miniature trains, radio, etc.

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200 MA 24 volt, ⅛in push movement.

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SELSYN MOTORS MAGSLIP

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E.M.I. type PRA-1 455 variable Kc
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Filter band with 50, 100, 200 L.F.
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No C45 set, 23 to 38 MHz complete with mast, headphones, mic, 24V power supply etc. **$95.00.**

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Hartley double beam oscilloscope. Type 13A with probes.
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WITH HANDSET ANTENNA WITHOUT BATTERY $25 EA
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7 TRANSISTOR **$55.00** Set of 2
1 watt, 11 transistor $142 set of 2.

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SORRY NO C.O.D.

Shortwave Scene

by Arthur Cushen, MBE

Radio Canada has discontinued its daily transmission to the South Pacific, a service which has been operating for nearly thirty years.

In an official statement Radio Canada International advises that due to an adjustment in the general policies of RCI, a shift has taken place in their priorities. This has compelled them to abandon their Oceanian service as of March 1977, until their priorities change or they complete the planned addition to their transmitter facilities.

In the meantime the station suggests that listeners should tune to the North American Service, which should provide fair reception during our afternoons. The transmissions in English are 0200-0230GMT on 6000, 9535kHz; 0300-0330 on 5960, 6000, 9535 and 9655kHz and 0400-0430 on 5960 and 9655kHz. Readers should also get fair reception for the period 2030-2100GMT when the programs are beamed to Europe on 11855, 15325 and 17820kHz.

Radio Canada has been broadcasting to the South Pacific for more than 30 years. Our files show that originally there was only a Sunday broadcast, the transmitters used having 50kW rating and located at Sackville. At that time CHOL on 11720kHz and CHLS on 9610kHz were beamed to Australia and New Zealand with a weekly transmission at 0815GMT. This was gradually increased to a daily transmission of one hour which has been a regular part of the Radio Canada schedule up to November, providing a service for our evening listening. During our summer a trial transmission 2000-2100GMT was broadcast for morning reception in this area, but this did not prove satisfactory.

ATHENS USES 9655kHz

The Voice of Greece, Athens, has been heard on the new frequency of 9655kHz during several transmissions. A broadcast in Greek has been noted 0800-0850GMT on this frequency at very good strength. A further transmission at 2100GMT is directed to Australia and has news in English at 2115GMT. Two frequencies have been noted with this transmission, 9655 and 9760kHz. At 2200GMT Athens is again heard on 9655kHz with its usual opening signal.

The address for reception reports is Direction of Technical Services, Voice of Greece, 16 Moyrouzi Street, P.O. Box 360, Athens, Greece.

ETLF CLOSES DOWN

At dawn on March 12 the Ethiopian Government moved in and took over ETLF, The Voice of The Gospel in Addis Ababa, Ethiopia. So ended the 14 years of gospel broadcasting from this station, frequently reported in this page as being heard by readers. At the time of the seizure the station was broadcasting in 14 languages to an audience in Africa and the Middle and Far Easts. The government claims that the station was not broadcasting in the national interest, but it is widely expected that this powerful station is to be used to counter propaganda from the Sudan, which has set up transmissions to back the breakaway group in the country.

Our first communication with ETLF was when the station opened, and they made the following announcement:

"A Christian Radio Station for Africa, Asia, The Near and Middle East. Inauguration: February 26, 1963. Radio Voice of the Gospel is owned and operated by the Lutheran World Federation Broadcasting Service. Affiliated in broadcasting with all Africa Conference of Churches, East Asian Christian Council, Near East Christian Council through their Co-ordinating Committee for Intercontinental Broadcasting."

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, NZ. All times are GMT. Add 8 hours for WAST, 10 hours for EAST and 12 hours for NZT.

OKINAWA CLOSURE

When Okinawa and the Ryuku Islands were handed back to Japan by the United States in 1972 it was expected that radio stations operated by the United States would have to close. Earlier this year the American Armed Forces Radio service ceased operation and later the Far East Broadcasting Company which operated JOFF also closed down.

The Voice of America will also be closing its relay base before May 14 and this consists of a medium wave transmitter of a million watts operating on 1178kHz and short-wave transmitters of 100, 35 and 10kW. These transmitters are located at Okuma and have been used for relaying the Voice of America to Asia as well as Indonesia, and have frequently been heard in this area. The closure of this relay base means that the Voice of America stations in the Philippines will be the main ones to re-broadcast VOA transmissions to the Asian area.

This includes the one million watts transmitter at Poro on 1140kHz and 8 shortwave transmitters of 100, 50 and 35kW, and those at Tinang which has 13 transmitters with the power from 250 to 50kW.

FEBC-SAIPAN

The Far East Broadcasting Company has closed down its station JOFF on Okinawa and moved to Saipan. Broadcasts from Saipan in the Marianas will include Gospel programs to Asia and the projected frequency is 940kHz.

This is not the first station for Saipan, which has had a station since 1945. When the area was won back from the Japanese the Voice of America began operating KSAI. This was a multi-frequency transmitter and operated on 860, 960, 1010 and 1080kHz according to our verification. At the same time the Voice of America was operating KRHO in Honolulu Hawaii, which was operating on several frequencies

ENGLISH FROM KOREA

Radio Korea in Seoul has extended its English transmissions and also introduced new frequencies. John Mainland in Wellington reports the use of 9675kHz at 0600GMT, while the BBC Monitoring Service lists the new schedule which does not show this

0300-0330GMT	9640, 9675kHz
1000-1030	7150, 9525, 9580
1130-1200	7150, 9665, 11860
1330-1400	11860
1600-1630	7150, 9640
1800-1830	9720
2000-2030	9665, 9720
2300-2330	9640.

MEDIUM-WAVE NEWS

CAYMEN ISLAND: Radio Caymen in the British West Indies has been heard on 1555kHz opening shortly before 1100GMT. This station has a power of 10kW and our reception was for the first 30 minutes of transmission which was of two transcribed Gospel programs. On other occasions the station has played recordings of a gospel nature and at times has been heard opening earlier than 1100GMT. Reception of the Caribbean stations is now fairly regular as other stations in the area have also been heard at this time.

NEW ZEALAND: The first synchronisation of Radio New Zealand stations is planned for the middle of the year and will cover the repeaters in the Northland area. 1YK 1010 will move to 830, in synchronisation with 1YX already on that frequency. 1ZK 1440 and 1ZN 970 will later synchronise on the vacated frequency of 1010. This will be followed by 1YE 1050 moving to 970. Finally, 2ZP New Plymouth will move from 1370 to 1050.

AUSTRALIA: The latest commercial station to open is 4GC Charters Towers Queensland operating on 1170kHz with 100W. The station relays the programs of 4AY Ayr, but has its own programs Sunday to Thursday 2300-0300GMT. Station 3LK Horsham has recently changed its call sign to 3WM and has been noted first by Merv Banks of Invercargill using this call. The station previously relayed 3DB Melbourne for most of its broadcast day, but is now operating mainly from its own studios. A frequency change has been noted for 4MK Mackay, which is now operating on 1030kHz having moved from 1380kHz.

LISTENING BRIEFS
EUROPE

HUNGARY: Radio Budapest has been heard on the new frequency of 7257kHz opening on Sundays at 0700GMT. This transmission is in Turkish and was formerly broadcast on 7215kHz. There is some interference from the Voice of Nigeria which is broadcasting in English at 0700GMT.

SWITZERLAND: According to Marconi of England a contract has been signed with the Swiss Post Telegraph and Telecommunications Authority, for the purchase of a further 250kW high frequency transmitter. This transmitter will be located at Schwarzenburg near Berne and will be used by the Swiss Broadcasting Corporation for their overseas service. it is expected to be in operation by the end of the year. This will be in addition to the present complement of one 500kW transmitter and seven of 250kW which are at present in operation.

AFRICA

GUINEA BISSAU: What is believed to be a new high powered transmitter is widely reported on 4780kHz. In North America reception has been during our morning period, while in this area signals have been noted to closing at 0800GMT with members of the ARDXC first reporting this signal from Melbourne.

SWAZILAND: According to Collin Miller in Johannesburg Trans World Radio Swaziland is operating on 5055kHz from 0430-0615 and 1600-1815GMT. Another frequency 11955kHz has been heard in New Zealand by Bryan Clark of Wellington at 1800GMT opening with an interval signal and then a broadcast in Portuguese.

ASIA

NEPAL: According to the BBC Monitoring Service, Radio Nepal at Kathmandu is using 100kW on 7105kHz. Radio Nepal's daily transmission schedule was given as: 0020-0350, 0720-1050 and 1150-1720 (including programs in English at 0220-0230 and 1435-1520) on 7105kHz (100kW), 5007kHz (5kW), 3424kHz (100kW) and 790kHz (100kW).

PHILIPPINES: Two listeners in Japan reporting to "Sweden Calling DXers" give details of a test transmission from DXH-2 in Davao City, Mindanao. The station has been heard testing on 7280kHz 0830-0900 and 1030GMT. The program consisted of music and announcements and the station is owned and operated by the University of Mindanao.

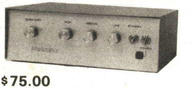
AMERICAS

HONDURAS: Radio Swan at San Pedro Sula has been heard by Peter Bunn of Melbourne on the new frequency of 6015kHz. The station formerly broadcast on 6000kHz and reception was between 0730 and 1015GMT on the new frequency. Radio Swan operates 24 hours a day with all programs in Spanish.

136 VICTORIA RD., MARRICKVILLE, NSW 2204 PHONE 51-3845

A.C.E. RADIO

MUSICOLOUR

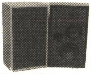


For the disco, light show, party, nites, or just relaxing . . . enjoy your records and tapes more with the new magical Musicolour Organ. Simple to connect to the home stereo or P.A. system. 3 channels, 1500 watts max. load each.

Fully constructed, ready to operate **$75.00**

Complete kit of top quality parts and instructions for the models 11 or 111 **$55.00**
P.P. NSW **$3.50**, interstate **$5.50**.

30 WATTS OF EXCELLENT HI-FI WITH PLAYMASTER LOUDSPEAKER SYSTEMS



3-41L. As described in June '76 E.A. Again features the mighty 8-30 woofer, with the advantage of the new Magnavox 6-25 midrange, and the more elaborate cross-over network. The dome tweeter is Philips AD0160/T8. Beautiful teak, or the ever popular walnut veneer cabinets are available. Either system can be carefully packed and despatched per airfreight passenger rail or road. Packed weight approx. 40kl. pair.

Fully finished teak or walnut cabinet only. **$38.50 ea.**

$96.00 each

HI FI CABINET KITS

Do it yourself—big savings. Our kits are extra easy to finish. Top, bottom, each side and back are factory assembled, baffle is pre-cut. Veneered pyneboard. Teak or walnut. Complete with innerbond and speaker grille cloth. 8-30 3-45L. systems. **$55.00** pair.
MV-50 system **$69.95** pair.

FAMOUS MAGNAVOX AUST. MADE LOUDSPEAKERS

MODEL.	Imp	Watts. Rms	Reson. Hz	Freq.Hz	V.C.Dia.	Price	P.P
10-40 10"	8	40	45	30-8000	1½"	**$23.00**	$2.50
8-30 8"	8	30	45	30-8000	1½"	**$19.00**	2.25
12WR 12"	8	16	45	30-16000	1'	**$16.50**	2.00
10WR 10"	8	16	45	30-16000	1"	**$13.90**	2.00
8WR 8"	8	16	45	30-16000	1"	**$11.80**	2.00
6WR 6½	8	12	45	30-16000	1"	**$10.90**	22.00
6.J 6½	15	8	85	80-7000	1"	**$8.50**	1.50
6-25 6½	8	25	45	45-6000	1½"	**$16.50**	2.00
XJ3 Dome	8/15	25	1500	2000-20000	1	**$8.95**	1.30

WESTON MARINE C-B TRANSCEIVER (PMG approved)

Auto noise limiter, squelch A.G.C. overmod limiter. Low pass filter for bandwidth. SPECS T-mitter. Crystal locked. 5 watts input to RF stage Freq. coverage. Any 11 channels in 27 MHz band. Receiver crystal locked double superhet. 6.5 MC and 455 Kc 1fs 3" speaker, dynamic mic. 50 ohm antenna. 20 t'sistors, 8 diodes 12 VDC operation. Sensitivity. 0.5UV 10dB. S/N Size 6½" x 2½" x 7¾" Wt. 4½ lbs.
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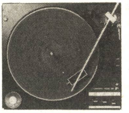

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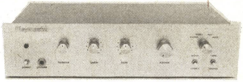

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STAGE & DISCO LIGHTING: I am trying to locate circuits for stage and disco lighting effects. Such things as dimmers, master dim and blackout circuits, light chasers, variable speed light flashers, high power strobes, etc, do not seem to be described in any magazines that I know of. Could you inform me of the source of any such circuits. (P.B., Beecroft, NSW.)

- We have described some of the devices you mention and offer the following references. Autodim, January 1976 (File No. 2/PC/21); Autodim, July 1971 (2/PC/14); 240V Lamp Flasher, November 1970 (2/PC/10). There have also been three Musicolour (colour organ) designs, the latest being in September 1976 (2/PC/23).

LEAD-ACID BATTERIES: Most books on lead-acid batteries list only two methods of assessing the battery's condition; a high current discharge or a specific gravity reading. The first method is rather brutal and the second method can be messy and inconvenient. Since the electrolyte is an ionised solution do you know of any method whereby the degree of ionisation can be measured and used to indicate the battery's condition? (D.A., Findon, S.A.)

- We know of no investigations along the lines you suggest, nor can we give any indication whether such a scheme would be practical. However, open circuit voltage does bear a significant relationship to specific gravity and expanded scale voltmeters can be used to give at least an approximate idea of battery condition. We refer you to "An Expanded Scale Automotive Voltmeter", March and April 1963 (File No. 7/M/21) and "A Voltmeter for Your Car", August 1965 (7/M/26).

SOLAR CELLS: Would it be possible for you to describe a battery charger (for Ni-Cad cells) using solar cells? I have noticed recently solar cells listed in some catalogues at quite reasonable prices. (A.C., Preston, Vic.)

- A solar cell charger was described in the July 1975 issue (File No. 3/MS/55) and reference to this may prove helpful. However, we would point out that we know of no really cheap solar cells, inasmuch as the lower priced ones deliver so little power that it would prove very expensive to provide enough of them to make the project worthwhile. Those delivering reasonable amounts of power are quite costly.

AM TUNER PERFORMANCE: Quite frequently in your pages you review the performance of AM/FM tuners and more often than not, after giving a glowing account of the performance of the FM section, you describe the AM section as the "poor relation", "typically mediocre", etc. As a large proportion of the listening available is on AM it seems logical that anyone in the market for an AM/FM tuner should be looking very critically at the specifications of the AM section.

I would like to know which specifications, in your opinion, should be quoted to adequately describe the performance of an AM tuner and what values you would expect them to have in a good quality unit.

Armed with this information I shall attempt to find a tuner good enough to connect to my Playmaster Twin Twenty Five (I congratulate you on this one. It is now running superbly after some initial problems with faulty BC549 transistors). (R.A., Glebe, NSW.)

- We wish you luck. Good quality AM tuners are few and far between and seldom, if ever, found in combination with an FM tuner. The parameters to refer to would be: distortion, frequency response, sensitivity, signal-to-noise ratio, selectivity, and cross-modulation. Distortion should be 1% or less, frequency response 8kHz or more (at 3dB point) with a 50dB signal-to-noise ratio for an aerial input of, say, 1 millivolt. The last two parameters are unlikely to be listed, even for a good design.

As you can see, the performance figures for a good quality AM tuner still fall a long way short of FM and are unlikely to be of much use anyway, when severe electrical interference (thunderstorms, electrical applicances) is present.

You may care to refer to two product reviews, one in July 1972 and the other in September 1974, which described tuners in the general class you are seeking.

Notes & Errata

LF AND VLF CONVERTER (March 1976, File No 3/CV/13): In the wiring diagram on page 59, the 27pF capacitor from the crystal should go to earth rather than to the +9V rail.

MUSICOLOUR III (September 1976, File No. 2/PC/23): A number of these units have exhibited random flickering of lights in each channel. The fault is worse with low mains voltage. It is due to pin 4 of the 555 being held low for too long. Increasing the 1k resistor in the voltage divider after the bridge rectifier (previously changed from 33k) to be between 2.2k and 4.7k cures the fault.

200MHz FREQUENCY METER (March 1977, File No. 7/F/21): The 74C925 cannot be substituted for the second 74C926 – while they are electrically similar except for the carry-output, they are not pin-for-pin compatible. Also the 47uF capacitor at the output of the CA3028 should have a rating of 6VW, not 35VW. Note that the lead diagram of the CA3028 on the circuit is the view from below, not above.

There have also been problems of random counting due to multiplex hash on the 5V supply line. The cure is as follows: Replace the two .047uF capacitors associated with the 27-ohm resistors with 100uF electrolytic capacitors; replace the long link which carries the 5V supply to the 74C926's with a 13mm balun former wound with six turns of light-gauge insulated hook-up wire.

Other comments: IC sockets are NOT recommended for the 74C926's or the 95H90. The input socket should be isolated from chassis and grounded at the input point on the PCB. The input switch should NOT be wired with shielded cable, apart from one short length from the switch to the LF input. The 10k resistor at pin 9 of the 7414 needs to be reduced to as low as 2.7k to obtain maximum sensitivity at high frequencies —this is a trial-and-error process.

If you are unable to complete an "Electronics Australia" project because you missed out on your regular issue, we can usually provide emergency assistance on the following basis:

PHOTOSTAT COPIES: $2 per project, or $2 per part where a project spreads over multiple issues. Requests can be handled more speedily if projects are positively identified, and if not accompanied by technical queries.

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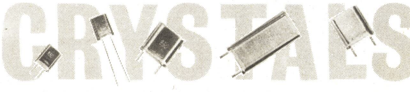

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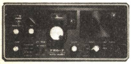

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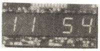

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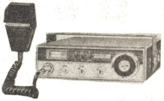

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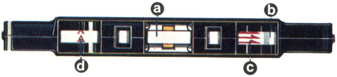

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JA-S71

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